Research Note 81-17

AN ANALYTICAL MODEL FOR DEVELOPING OBJECTIVE MEASURES OF AIR CREW PROFICIENCY WITH MULTIVARIATE TIME SEQUENCED DATA

VOLUME II. COMPUTER PROGRAM DOCUMENTATION

Edward M. Connelly, Pamela Johnson
Performance Measurement Associates, Inc.

Brian D. Shipley, Jr.
Army Research Institute

ARI FIELD UNIT AT FORT RUCKER, ALABAMA

U. S. Army
Research Institute for the Behavioral and Social Sciences

May 1981

REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER Research Note 81-17	2. GOVT ACCESSION NO. AD A127 313
	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) An Analytical Model for Developing Objective Measures of Air Crew Proficiency with Multivariate Time Sequenced Data. Volume II. Computer Program Documentation	5. TYPE OF REPORT & PERIOD COVERED Final - Jan 1980- May 81
	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Edward M. Connelly, Pamela Johnson (PMA), and Brian D. Shipley (ARI)	8. CONTRACT OR GRANT NUMBER(s) MDA 903-80-C-0198
9. PERFORMING ORGANIZATION NAME AND ADDRESS Performance Measurement Associates, Inc. 410 Pine Street, S.E. Vienna, Virginia 22333	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 2Q162717A790
11. CONTROLLING OFFICE NAME AND ADDRESS Army Research Institute for the Behavioral and Social Sciences. 5001 Eisenhower Avenue, Alexandria, Virginia 22333	12. REPORT DATE May 1981
	13. NUMBER OF PAGES
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)	15. SECURITY CLASS. (of this report) Unclassified
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Nap-of-the-earth flight	Night reconnaissance
Night flight	
Night vision	

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This volume contains computer programs used to analyze the subject data, procedures for the use of the programs, and example outputs. These programs are the result of a theoretical investigation of analytic methods for deriving differential weighting functions from preselected samples of multivariate, time sequenced observations of aircrew performance. The research effort resulted in an analytic model which could be used to prepare and to further investigate differential weighting functions as a means of establishing relationships between time sequenced observations of aircrew performance (over)

item 20. continued

and independent assessments of aircrew proficiency,(Volume I. Analysis and Results, RN 81-16).

TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

LIST OF TABLES

INTRODUCTION

Volume II, Computer Program Documentation, was prepared under Contract No. MDA 903-80-C-0198, entitled "An Analytical Model for Developing Objective Measures of Air Crew Proficiency with Multivariate Time Sequenced Data." This second volume provides documentation of the basic computer programs used in the processor termed "Measurement Analysis Processor" (MAP).

The computer programs were designed to make extensive use of subprograms so that common functions used in the various programs could also use common subroutines. Furthermore, the structured approach to programming was used - to the degree that the unstructured FORTRAN language would permit. However, in the initial programming efforts limited use of the "go to" statements was maintained; but it was necessary for program variation to insert some "go to" statements which of course complicated the program structure. We hope this additional complication will not lead to difficulties in using or modifying the programs.

This volume contains programs used to analyze the subject data, procedures for use of the programs, and example outputs.

On the procedure page, the user inputs are examples from data files at PMA.

The computer used is an LSI/11, utilizing floppy discs containing programs and data. The DK: referred to on the procedure page corresponds to the disc drive used by the machine operator.

The subscripts indicating footnotes on the procedure page do not appear on the screen as computer outputs.

Program Listing INTHEX

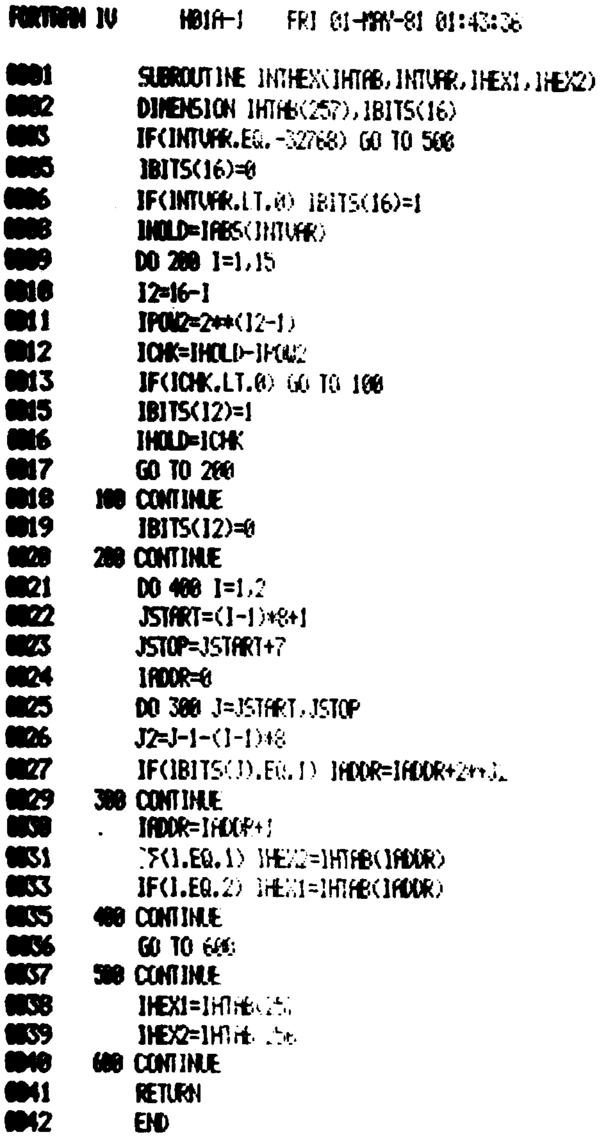
```
C PROGRAM 'INTHEX'
C PURPOSE: CONVERT C-50 DATA FILE TO HEXIDECIMAL NOTATION
C AND FORMAT DATA FOR TRANSMISSION OVER PHONE LINES
C USER SPECIFIES FILE NAME, BEGINNING LOCATION, AND
C NUMBER OF BLOCKS TO PROCESS
$INSERT SYSCOM>KEYS.F
      DIMENSION INBUF(15240),IOUTB(508),NAME1(8),
     1          IHTAB(257)
      INTEGER*4 IF1POS
      DATA IHTAB/'00','01','02','03','04','05','06','07',
     1          '08','09','0A','0B','0C','0D','0E','0F',
     1          '10','11','12','13','14','15','16','17',
     1          '18','19','1A','1B','1C','1D','1E','1F',
     1          '20','21','22','23','24','25','26','27',
     1          '28','29','2A','2B','2C','2D','2E','2F',
     1          '30','31','32','33','34','35','36','37',
     1          '38','39','3A','3B','3C','3D','3E','3F',
     1          '40','41','42','43','44','45','46','47',
     1          '48','49','4A','4B','4C','4D','4E','4F',
     1          '50','51','52','53','54','55','56','57',
     1          '58','59','5A','5B','5C','5D','5E','5F',
     1          '60','61','62','63','64','65','66','67',
     1          '68','69','6A','6B','6C','6D','6E','6F',
     1          '70','71','72','73','74','75','76','77',
     1          '78','79','7A','7B','7C','7D','7E','7F',
     1          '80','81','82','83','84','85','86','87',
     1          '88','89','8A','8B','8C','8D','8E','8F',
     1          '90','91','92','93','94','95','96','97',
     1          '98','99','9A','9B','9C','9D','9E','9F',
     1          'A0','A1','A2','A3','A4','A5','A6','A7',
     1          'A8','A9','AA','AB','AC','AD','AE','AF',
     1          'B0','B1','B2','B3','B4','B5','B6','B7',
     1          'B8','B9','BA','BB','BC','BD','BE','BF',
     1          'C0','C1','C2','C3','C4','C5','C6','C7',
     1          'C8','C9','CA','CB','CC','CD','CE','CF',
     1          'D0','D1','D2','D3','D4','D5','D6','D7',
     1          'D8','D9','DA','DB','DC','DD','DE','DF',
     1          'E0','E1','E2','E3','E4','E5','E6','E7',
     1          'E8','E9','EA','EB','EC','ED','EE','EF',
     1          'F0','F1','F2','F3','F4','F5','F6','F7',
     1          'F8','F9','FA','FB','FC','FD','FE','FF','0F'/
C NAME INPUT FILE
      WRITE(1,1010)
      READ(1,1011) (NAME1(I),I=1,8)
C ENTER STARTING WORD NUMBER
      WRITE(1,1030)
      READ(1,1031) IF1POS
C ENTER NUMBER OF BLOCKS (#BLOCKS < = 29) TO READ
      WRITE(1,1040)
      READ(1,1041) NUMBLK
      NUMWRD=NUMBLK*254
C OPEN INPUT FILE
      CALL SRCH$$(K$READ,NAME1,16,1,JTYPE1,ICODE1)
      IF(ICODE1.NE.0) GO TO 300
C POSITION INPUT FILE TO BEGINNING WORD LOCATION
```

```
C AND READ IN WORDS AHEAD
      CALL PRWF$$(K$READ+K$PREA,1,LOC(INBUF),NUMWRD,IFIPOS,
     1            NW1,IPCOD1)
      IF(IPCOD1.NE.0) GO TO 500
C CLOSE INPUT FILE
      CALL SRCH$$(K$CLOS,0,0,1,0,ICODE1)
      IF(ICODE1.NE.0) GO TO 600
C PROCESS INPUT WORDS AND WRITE LISTING
      WRITE(1,1050)
      READ(1,1051) IA1
      IF(IA1.NE.'GO') GO TO 900
      K=0
      DO 200 I=1,NUMBLK
      DO 100 J=1,254
      K=K+1
      INTVAR=INBUF(K)
      CALL INTHEX(IHTAB,INTVAR,IHEX1,IHEX2)
      L1=(J-1)*2+1
      L2=L1+1
      IOUTB(L1)=IHEX1
      IOUTB(L2)=IHEX2
  100 CONTINUE
      WRITE(1,1200) (IOUTB(II),II=9,508)
  200 CONTINUE
      GO TO 900
  300 CONTINUE
      WRITE(1,1110)
      GO TO 900
  500 CONTINUE
      WRITE(1,1130)
      GO TO 900
  600 CONTINUE
      WRITE(1,1140)
      GO TO 900
  900 CONTINUE
      CALL EXIT
 1010 FORMAT(' NAME INPUT FILE')
 1011 FORMAT(8A2)
 1030 FORMAT(' ENTER BEGINNING WORD [START=WORD(0)]')
 1031 FORMAT(I8)
 1040 FORMAT(' ENTER NUMBER OF BLOCKS TO READ (1 < = # BLOCKS < = 29)')
 1041 FORMAT(I8)
 1050 FORMAT(' ENTER  'GO'  TO START TRANSMISSION AFTER'/
     1       ' HITTING FUNCTION KEY #4 AND TRANSMISSION'/
     1       ' COMMAND IS REQUESTED')
 1051 FORMAT(A2)
 1110 FORMAT(' OPEN FAILED FOR INPUT FILE')
 1130 FORMAT(' POSITION-READ FAILED FOR INPUT FILE')
 1140 FORMAT(' CLOSE FAILED FOR INPUT FILE')
 1200 FORMAT(40A2)
      END
      SUBROUTINE INTHEX(IHTAB,INTVAR,IHEX1,IHEX2)
      DIMENSION IHTAB(16),IBITS(16)
      IF(INTVAR.EQ.[illegible]) GO TO 500
      IBITS(16)=0
      IF(INTVAR.LT.[illegible]
```

Program Listing INTHEX (Concluded)

```
      IHOLD=IABS(INTVAL)
      DO 200 I=1,15
      I2=16-I
      IPOW2=2**(I2-1)
      ICHK=IHOLD-IPOW2
      IF(ICHK.LT.0) GO TO 100
      IBITS(I2)=1
      IHOLD=ICHK
      GO TO 200
  100 CONTINUE
      IBITS(I2)=0
  200 CONTINUE
      DO 400 I=1,2
      JSTART=(I-1)*8+1
      JSTOP=JSTART+7
      IADDR=0
      DO 300 J=JSTART,JSTOP
      J2=J-1-(I-1)*8
      IF(IBITS(J).EQ.1) IADDR=IADDR+2**J2
  300 CONTINUE
      IADDR=IADDR+1
      IF(I.EQ.1) IHEX2=IHTAB(IADDR)
      IF(I.EQ.2) IHEX1=IHTAB(IADDR)
  400 CONTINUE
      GO TO 600
  500 CONTINUE
      IHEX1=IHTAB(257)
      IHEX2=IHTAB(256)
  600 CONTINUE
      RETURN
      END
```

Subroutine INTHEX



```
FORTRAN IV      HB1A-1     FRI 01-MAY-81 01:43:36               PAGE 001

              SUBROUTINE INTHEX(IHTAB,INTVAR,IHEX1,IHEX2)
              DIMENSION IHTAB(257),IBITS(16)
              IF(INTVAR.EQ.-32768) GO TO 500
              IBITS(16)=0
              IF(INTVAR.LT.0) IBITS(16)=1
              IHOLD=IABS(INTVAR)
              DO 200 I=1,15
              I2=16-I
              IPOW2=2**(I2-1)
              ICHK=IHOLD-IPOW2
              IF(ICHK.LT.0) GO TO 100
              IBITS(I2)=1
              IHOLD=ICHK
              GO TO 200
        100   CONTINUE
              IBITS(I2)=0
        200   CONTINUE
              DO 400 I=1,2
              JSTART=(I-1)*8+1
              JSTOP=JSTART+7
              IADDR=0
              DO 300 J=JSTART,JSTOP
              J2=J-1-(I-1)*8
              IF(IBITS(J).EQ.1) IADDR=IADDR+2**J2
        300   CONTINUE
              IADDR=IADDR+1
              IF(I.EQ.1) IHEX2=IHTAB(IADDR)
              IF(I.EQ.2) IHEX1=IHTAB(IADDR)
        400   CONTINUE
              GO TO 600
        500   CONTINUE
              IHEX1=IHTAB(255)
              IHEX2=IHTAB(256)
        600   CONTINUE
              RETURN
              END
```

Table 1

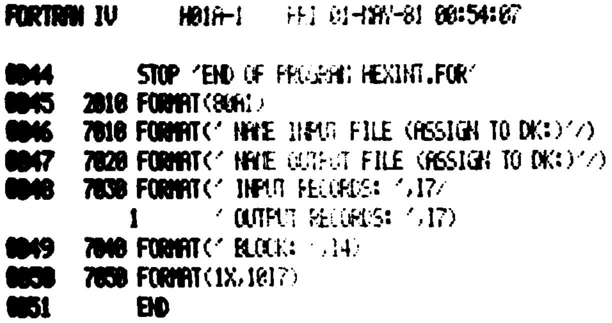
INTHEX

<table>
<tr><th colspan="2">Integer to Hexidecimal</th></tr>
<tr><td colspan="2">Purpose: To convert a data file to hexidecimal notation for better transmission from time-sharing facilities.
Note: The procedure will change with different time-sharing companies.</td></tr>
<tr><td>Computer Output</td><td>User Input</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
</table>

Program Listing HEXINT

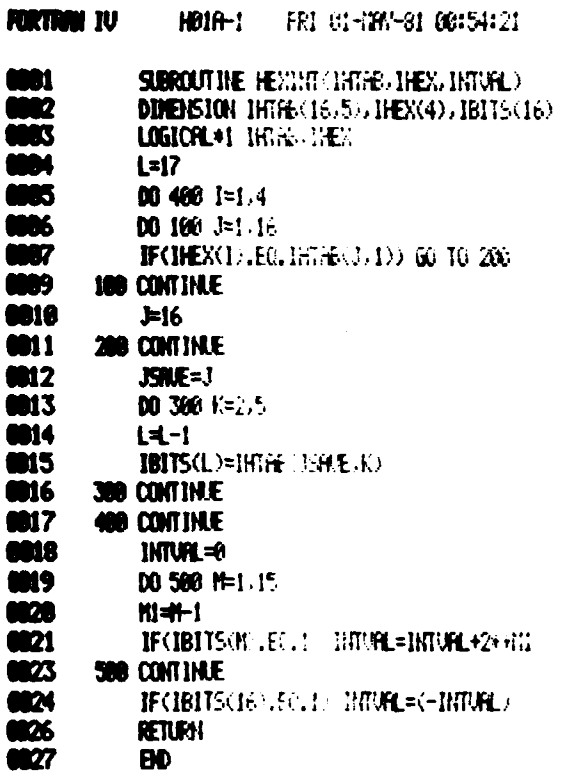
```
FORTRAN IV      H01A-1    FRI 01-MAY-81 08:54:07              PAGE 001

        C PROGRAM 'HEXINT.FOR'
        C PURPOSE: CONVERT HEXIDECIMAL DATA FILE READ FROM DIALCOM
        C BACK TO BINARY UNFORMATTED (PROGRAM INTHEX AT DIALCOM)
        C CONTRACT C-50
        C ARMY RESEARCH INSTITUTE
        C 06-AUG-80
0001          DIMENSION IDATA1(250,4),IDATA2(250),IHTAB(16,5),IHEX(4)
0002          LOGICAL*1 IDATA1,IHTAB,IHEX,IGG
0003          DATA IHTAB/'0','1','2','3','4','5','6','7',
             1          '8','9','A','B','C','D','E','F',
             1          0,0,0,0,0,0,0,0,1,1,1,1,1,1,1,1,
             1          0,0,0,0,1,1,1,1,0,0,0,0,1,1,1,1,
             1          0,0,1,1,0,0,1,1,0,0,1,1,0,0,1,1,
             1          0,1,0,1,0,1,0,1,0,1,0,1,0,1,0,1/,
             1     IGG/'G'/
0004          PAUSE 'INSERT I/O DATA DISC IN UNIT ONE (DK:) AND HIT RETURN'
0005          WRITE(7,7010)
0006          CALL ASSIGN(2,' ',-1,'RDO','NC',1)
0007          WRITE(7,7020)
0008          CALL ASSIGN(3,' ',-1,'NEW','NC',1)
0009          RBIGN=(-32768.0)
0010          IBIGN=INT(RBIGN)
0011          IOUT=0
0012          IN=0
0013          IDUM1=1234
0014          IDUM2=4321
0015          IDUM3=508
0016          IDUM4=0
0017          IDUM5=504
0018          IDUM6=0
0019      200 CONTINUE
0020          READ(2,[illegible]END=500) ((IDATA1(I,J),J=1,4),I=1,250)
0021          IN=IN+1
0022          DO 210 I=1,250
0023          IHEX(1)=[illegible] I,1)
0024          IF(IHEX(1) [illegible]) GO TO 205
0026          IHEX(2)=IDATA1(I,2)
0027          IHEX(3)=IDATA1(I,3)
0028          IHEX(4)=IDATA1(I,4)
0029          CALL HEXINT([illegible] IHEX,INTVAR)
0030          IDATA2([illegible]
0031          GO TO 210
0032      205 CONTINUE
0033          IDATA2 [illegible]
0034      210 CONTINUE
0035          WRITE([illegible] IDUM2,IDUM3,IDUM4,IDUM5,IDUM6,(IDATA2(I),I=1,250)
0036          IOUT=IOUT+1
0037          WRITE(7,[illegible] IOUT
0038          WRITE([illegible] (IDATA2(I),I=1,250)
0039          GO TO 200
0040      500 CONTINUE
0041          CALL CLOSE[illegible]
0042          CALL CL[illegible]
0043          WRITE([illegible] IOUT
```

Program Listing HEXINT (Concluded)



```
FORTRAN IV      H01A-1    FRI 01-MAY-81 00:54:07               PAGE 002

            STOP 'END OF PROGRAM HEXINT.FOR'
      2010  FORMAT(80A1)
      7010  FORMAT(' NAME INPUT FILE (ASSIGN TO DK:)'/)
      7020  FORMAT(' NAME OUTPUT FILE (ASSIGN TO DK:)'/)
      7030  FORMAT(' INPUT RECORDS: ',I7/
           1       ' OUTPUT RECORDS: ',I7)
      7040  FORMAT(' BLOCK: ',I4)
      7050  FORMAT(1X,10I7)
            END
```

Subroutine HEXINT



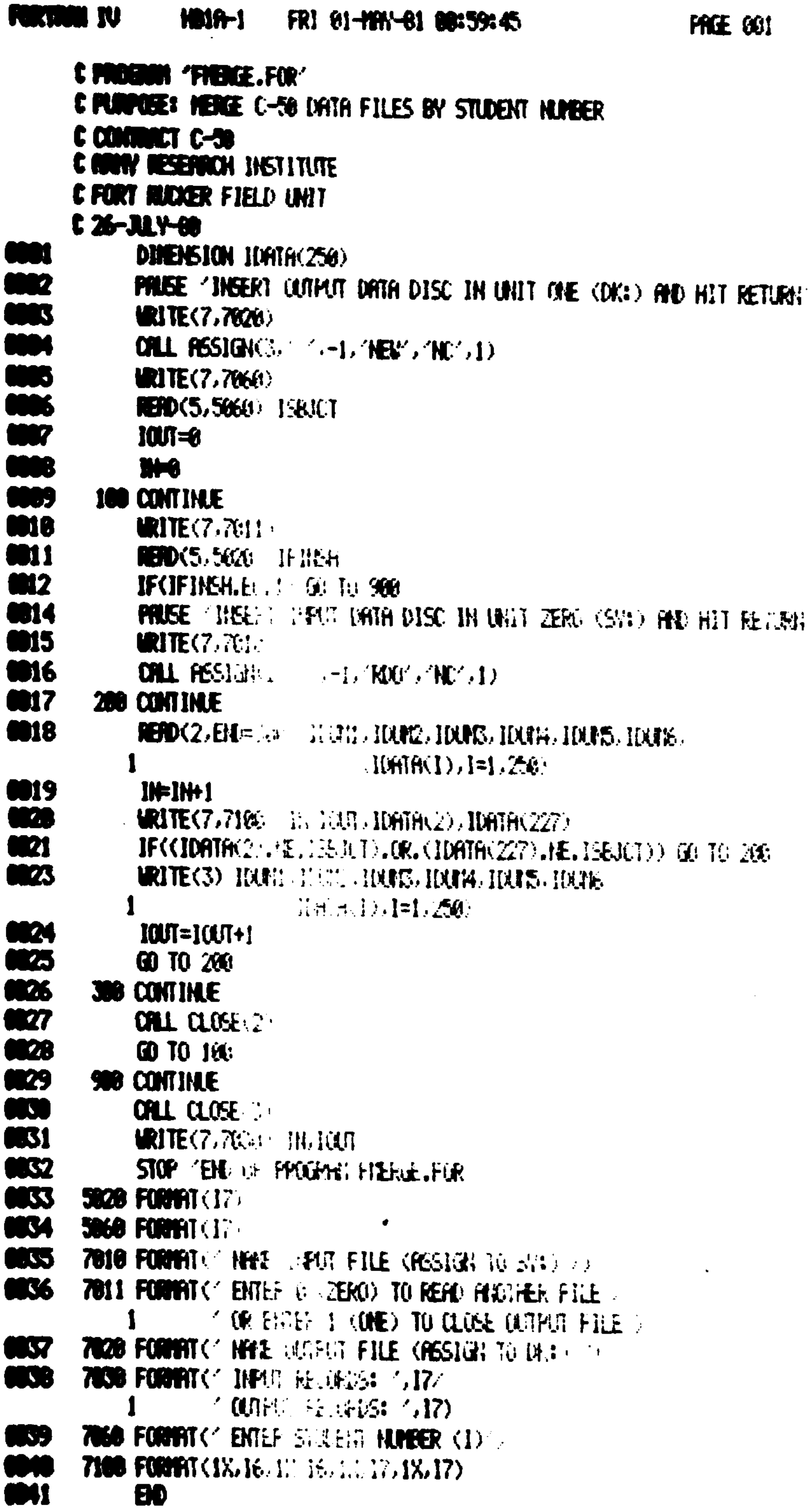
```
FORTRAN IV      H01A-1    FRI 01-MAY-81 00:54:21              PAGE 001

0001          SUBROUTINE HEXINT(IHTAB,IHEX,INTVAL)
0002          DIMENSION IHTAB(16,5),IHEX(4),IBITS(16)
0003          LOGICAL*1 IHTAB,IHEX
0004          L=17
0005          DO 400 I=1,4
0006          DO 100 J=1,16
0007          IF(IHEX(I).EQ.IHTAB(J,1)) GO TO 200
0009      100 CONTINUE
0010          J=16
0011      200 CONTINUE
0012          JSAVE=J
0013          DO 300 K=2,5
0014          L=L-1
0015          IBITS(L)=IHTAB(JSAVE,K)
0016      300 CONTINUE
0017      400 CONTINUE
0018          INTVAL=0
0019          DO 500 M=1,15
0020          M1=M-1
0021          IF(IBITS(M).EQ.1) INTVAL=INTVAL+2**M1
0023      500 CONTINUE
0024          IF(IBITS(16).EQ.1) INTVAL=(-INTVAL)
0026          RETURN
0027          END
```

Table 2

HEXINT.FOR

<table>
<tr><th colspan="2">Hexidecimal to Integer</th></tr>
<tr><td colspan="2">Purpose: To convert a hexidecimal data file to an integer data file.</td></tr>
<tr><th>Computer Output</th><th>User Input</th></tr>
<tr><td></td><td>● Run HEXINT
⟨CR⟩</td></tr>
<tr><td>Pause--I/O data disc in unit one (DK:) and hit return.</td><td>⟨CR⟩</td></tr>
<tr><td>Name input file (assign to DK:)</td><td>*DK:TTEST3.DAT
⟨CR⟩</td></tr>
<tr><td>Name output file (assign to DK:)</td><td>*DK:TTEST4.DAT
⟨CR⟩</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
</table>

Program Listing FMERGE



```
FORTRAN IV      V01A-1    FRI 01-MAY-81 08:59:45          PAGE 001

        C PROGRAM 'FMERGE.FOR'
        C PURPOSE: MERGE C-50 DATA FILES BY STUDENT NUMBER
        C CONTRACT C-50
        C ARMY RESEARCH INSTITUTE
        C FORT RUCKER FIELD UNIT
        C 26-JULY-80
              DIMENSION IDATA(250)
              PAUSE 'INSERT OUTPUT DATA DISC IN UNIT ONE (DK:) AND HIT RETURN'
              WRITE(7,7020)
              CALL ASSIGN(3,' ',-1,'NEW','NC',1)
              WRITE(7,7060)
              READ(5,5060) ISBJCT
              IOUT=0
              IN=0
          100 CONTINUE
              WRITE(7,7011)
              READ(5,5020) IFINSH
              IF(IFINSH.EQ.1) GO TO 900
              PAUSE 'INSERT INPUT DATA DISC IN UNIT ZERO (SY:) AND HIT RETURN'
              WRITE(7,7010)
              CALL ASSIGN(2,' ',-1,'RDO','NC',1)
          200 CONTINUE
              READ(2,END=300) IDUM1,IDUM2,IDUM3,IDUM4,IDUM5,IDUM6,
             1                (IDATA(I),I=1,250)
              IN=IN+1
              WRITE(7,7100) IN,IOUT,IDATA(2),IDATA(227)
              IF((IDATA(2).NE.ISBJCT).OR.(IDATA(227).NE.ISBJCT)) GO TO 200
              WRITE(3) IDUM1,IDUM2,IDUM3,IDUM4,IDUM5,IDUM6,
             1                (IDATA(I),I=1,250)
              IOUT=IOUT+1
              GO TO 200
          300 CONTINUE
              CALL CLOSE(2)
              GO TO 100
          900 CONTINUE
              CALL CLOSE(3)
              WRITE(7,7030) IN,IOUT
              STOP 'END OF PROGRAM FMERGE.FOR'
         5020 FORMAT(I7)
         5060 FORMAT(I7)
         7010 FORMAT(' NAME INPUT FILE (ASSIGN TO SY:) ')
         7011 FORMAT(' ENTER 0 (ZERO) TO READ ANOTHER FILE'/
             1       ' OR ENTER 1 (ONE) TO CLOSE OUTPUT FILE')
         7020 FORMAT(' NAME OUTPUT FILE (ASSIGN TO DK:) ')
         7030 FORMAT(' INPUT RECORDS: ',I7/
             1       ' OUTPUT RECORDS: ',I7)
         7060 FORMAT(' ENTER STUDENT NUMBER (I)')
         7100 FORMAT(1X,I6,1X,I6,1X,I7,1X,I7)
              END
```

Table 3

FMERGE.FOR

<table>
<tr><th colspan="2">Merge Data Files by Student Number</th></tr>
<tr><td colspan="2">Purpose: The program FMERGE is used when a subject's data is located in two different areas (i.e., 2 different discs). FMERGE will bring both sets of data together to form a single subject file.</td></tr>
<tr><td>Computer Output</td><td>User Input</td></tr>
<tr><td></td><td>● Run FMERGE
<CR></td></tr>
<tr><td>Pause - Insert output data disc in unit one (DK:) and hit RETURN</td><td><CR></td></tr>
<tr><td>Name Output File</td><td>*DK:TTEST3.DAT
<CR></td></tr>
<tr><td>Enter Student Number (I)[1]</td><td>20935
<CR></td></tr>
<tr><td>Enter 0 (zero) to read another file or enter 1 (one) to close output file</td><td>1
<CR></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
</table>

[1] Integer

Program Listing DFLIST

```
FORTRAN IV      H01A-1    FRI 01-MAY-81 01:10:42              PAGE 001

      C PROGRAM 'DFLIST.FOR'
      C LIST THE C-50 DATA FILE
              DIMENSION X(29,10)
              INTEGER X
              NBLOCK=0
              PAUSE 'INSERT DATA DISC IN DK: AND HIT RETURN'
              WRITE(7,7000)
              CALL ASSIGN(2,' ',-1,'RDO','NC',1)
              WRITE(7,7010)
              READ(7,7011) IUNIT
          100 CONTINUE
              CALL INPUT(X,NBLOCK,MARK,2)
              IF(MARK.EQ.-2) GO TO 999
              DO 200 I=1,29
              WRITE(IUNIT,7020) NBLOCK,I,(X(I,J),J=1,10)
          200 CONTINUE
              GO TO 100
          999 CONTINUE
              STOP
         7000 FORMAT(' NAME INPUT FILE: '/)
         7010 FORMAT(' ENTER UNIT NUMBER FOR LISTING (6,7): ')
         7011 FORMAT(I7)
         7020 FORMAT(' ',I3,2X,I2,10I7)
              END
```

Subroutine INPUT

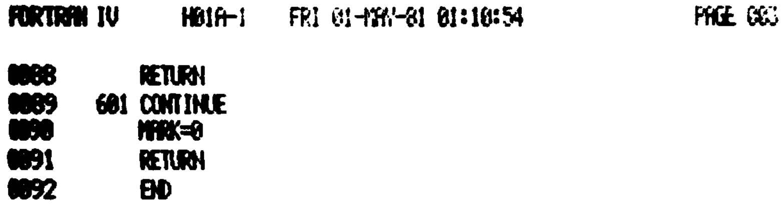
```
FORTRAN IV      H01A-1    FRI 01-MAY-81 01:10:54              PAGE 001

              SUBROUTINE INPUT(X,NBLOCK,MARK,N)
              INTEGER DATA,X
              DIMENSION DATA(250),X(29,10)
              IP=0
              IPL=0
              DO 10 J=1,10
              DO 10 I=1,29
              X(I,J)=0
         10 CONTINUE
              MARK=0
              READ(N,END=500,ERR=600) IDUM1,IDUM2,IDUM3,IDUM4,IDUM5,IDUM6,
           1                            (DATA(I),I=1,250)
              NBLOCK=NBLOCK+1
              K=0
        C MAIN LOOP
              DO 100 J=1,10
              K=K+2
        C STUDENT NUMBER
              X(1,J)=DATA(K)
        C PERIOD
              K=K+2
              X(2,J)=MOD(DATA(K),256)
        C SEGMENT NUMBER
              K=K+10
              DO 20 I=1,[illegible]
              K=K+1
              NTK=MOD(DATA([illegible]),2)
              X(3,J)=X(3,J)+MARK
              DATA(K)=DATA[illegible]
         20 CONTINUE
              K=K-12
         30 LPS=DATA([illegible])+IP
              IF(IPL.LT.[illegible]) GO TO 40
              IP=IP+256
              GO TO 30
         40 IPL=LPS
              X(4,J)=LPS
        C STICK X (ROLL INPUT) SCALING IS INCHES TIMES 100 MAX=6.24
              DO 50 I=5,[illegible]
              K=K+1
              Y=FLOAT(DATA(K))*0.013044+ISIGN(5,DATA(K))/10.0
              X(I,J)=INT(Y)
         50 CONTINUE
        C STICK Y (PITCH INPUT) SCALING IS INCHES TIMES 100 MAX=6.330
              DO 60 I=9,1[illegible]
              K=K+1
              Y=FLOAT(DATA(K))*0.019323+ISIGN(5,DATA(K))/10.0
              X(I,J)=INT(Y)
         60 CONTINUE
              DO 70 I=[illegible]
              K=K+1
        C SIDE TASK STA[illegible]
              NTK=MOD([illegible])
              DATA(K)=[illegible]
```

Copy available to DTIC does not permit fully legible reproduction

Subroutine INPUT (Continued)

```
FORTRAN IV      H01A-1    FRI 01-MAY-81 01:10:54              PAGE 002

0048          X(26,J)=X(26,J)+100*NTK
        C PEDAL POSTION SCALING IS INCHES TIMES 100 MAX=3.25"
0049          Y=FLOAT(DATA(K))+0.009919+ISIGN(5,DATA(K))/10.0
0050          X(I,J)=INT(Y)
0051     70 CONTINUE
        C PITCH INDICATED MAX=60 DEGREES, SCALED TIMES 100
0052          DO 80 I=15,16
0053          K=K+1
0054          DATA(K)=DATA(K)-MOD(DATA(K),2)
0055          Y=FLOAT(DATA(K))+0.54935+ISIGN(5,DATA(K))/10.0
0056          X(I,J)=INT(Y)
0057     80 CONTINUE
        C ROLL INDICATED MAX=30 DEGREES, SCALED TIMES 100
0058          DO 90 I=17,18
0059          K=K+1
0060          DATA(K)=DATA(K)-MOD(DATA(K),2)
0061          Y=FLOAT(DATA(K))+0.54932+ISIGN(5,DATA(K))/10.0
0062          X(I,J)=INT(Y)
0063     90 CONTINUE
        C ALTITUDE
0064          K=K+1
0065          X(19,J)=DATA[illegible]
        C TORQUE   0 TO 10[illegible]
0066          K=K+1
0067          X(20,J)=DATA[illegible]
        C AIRSPEED MAX=14[illegible] KNOTS, SCALED TIMES 100
0068          X(21,J)=6*MOD[illegible],256)
        C HEADING 0 TO 360 DEGREES, SCALED TIMES 100
0069          K=K+1
0070          X(22,J)=FLOAT[illegible]+0.54932+ISIGN(5,DATA[illegible]10.0
        C VERTICAL VELOCITY
0071          K=K+1
0072          X(23,J)=DATA[illegible]
        C YAW 0 TO 14.9 [illegible] SCALED TIMES 100
0073          K=K+1
0074          X(24,J)=FLOAT[illegible]+0.0454[illegible]+ISIGN(5,DATA[illegible]10.0
        C COURSE DEVIATION
0075          K=K+1
0076          X(25,J)=FLOAT[illegible]+0.549[illegible]+ISIGN(5,DATA(K))/10.0
        C SIDE TASK NUMBER
0077          K=K-21
0078          X(26,J)=X(26,[illegible]MOD(DATA(K),256)
        C GENERATOR REC[illegible]
0079          X(29,J)=DATA[illegible]
        C STATION SELECT [illegible]
0080          K=K+22
0081          X(27,J)=DATA[illegible]
        C MIKE RESPONSE [illegible]
0082          X(28,J)=MOD([illegible],256)
0083    100 CONTINUE
0084          MARK=10
0085          RETURN
0086    501 CONTINUE
0087          MARK=-2
```

Subroutine INPUT (Concluded)



```
FORTRAN IV      H01A-1    FRI 01-MAY-81 01:10:54              PAGE 003

0088          RETURN
0089     601 CONTINUE
0090          MARK=0
0091          RETURN
0092          END
```

Table 4

DFLIST.FOR

List of Data File	
Purpose: Reads the data file and presents the information on the CRT.	
Computer Output	**User Input**
	● Run DFLIST ⟨CR⟩
Pause -- Insert data disc in DK: and hit return	⟨CR⟩
Name input file	*DK:F20935.DAT ⟨CR⟩
Enter unit number for listing (6,7):[1]	6 ⟨CR⟩

[1] 6 = line printer

7 = teletype

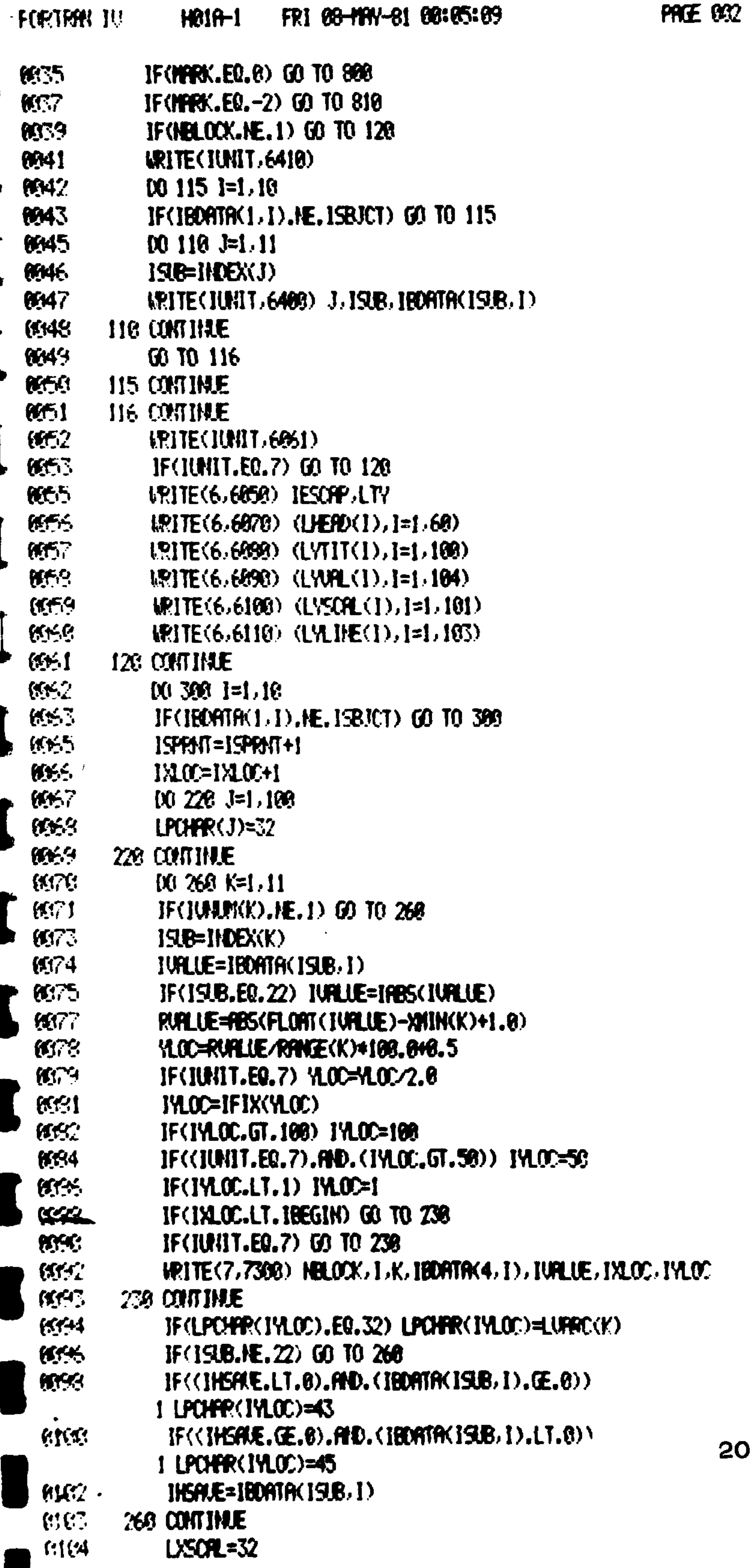
Example Output - DFLIST

```
1  1  20935  20935  20935  20935  20935  20935  20935  20935  20935  20935   Subject No.
1  2      3      3      3      3      3      3      3      3      3      3   Session No.
1  3      0      0      0      0      0      0      0      0      0      0
1  4     81     83     85     87     89     91     93     95     97     99
1  5   -209   -213   -213   -208   -178   -159   -160   -146   -152   -158   Stick X Position
1  6   -212   -213   -214   -210   -180   -159   -158   -151   -153   -159
1  7   -213   -214   -213   -210   -166   -159   -156   -146   -155   -158
1  8   -212   -213   -212   -177   -159   -159   -156   -152   -157   -159
1  9    334    334    333    333    337    333    356    358    341    343   Stick 4 Position
1 10    335    334    335    333    336    321    306    364    341    343
1 11    335    336    334    331    337    314    301    361    341    340
1 12    334    334    334    336    335    333    302    341    341    338
1 13    -37    -37    -36    -36    -36    -36    -36    -36    -36    -38   Pedal Position
1 14    -37    -37    -36    -36    -36    -36    -36    -36    -36    -38
1 15    559    697    775    775    773    615    592    598    266    224   Pitch Angle
1 16    637    745    784    753    667    593    555    426    237    171
1 17   -560   -950  -1327  -1684  -1834  -1856  -2001  -2190  -2198  -2465   Roll Angle
1 18   -758  -1141  -1514  -1847  -1859  -1913  -2100  -2128  -2310  -2596
1 19   1526   1561   1599   1637   1671   1701   1727   1749   1764   1769   Altitude
1 20     35     35     35     35     35     35     35     35     35     35   Torque
1 21    918    906    894    882    876    876    882    894    912    942   Airspeed
1 22  15542  15307  14918  14383  13738  13050  12303  11467  10713   9792   Heading
1 23   1012   1178   1244   1182   1039    880    749    657    313     12   Vertical Velocity
1 24    -45    -47    -50    -53    -60    -60    -58    -58    -56    -50   Yaw Angle
1 25  -2785  -2786  -2787  -2789  -2792  -2795  -2799  -2805  -2810  -2816
1 26      0      0      0      0      0      0      0      0      0      0
1 27      0      0      0      0      0      0      0      0      0   -128
1 28      0      0      0      0      0      0      0      0      0      0
1 29      0      0      0      0      0      0      0      0      0      0
```

Program Listing STRPLT

```
FORTRAN IV      H01A-1    FRI 08-MAY-81 08:05:09              PAGE 001

        C PROGRAM: 'STRPLT.FOR'
        C PURPOSE IS TO PLOT C-50 VARIABLES ON LINE PRINTER
        C DATE: JULY 26, 1980
        C ARMY RESEARCH INSTITUTE, FORT RUCKER
0001          LOGICAL*1 LHEAD,LPCHAR,LYTIT,LYSCAL,LXSCAL,
             1          LYLINE,LXLINE,LVARC,IESCAP,LTY,LYVAL
0002          DIMENSION LPCHAR(100),IBDATA(29,10),LHEAD(60),
             1          LYSCAL(101),LYLINE(103),
             1          LVARC(16),IVNUM(16),LYTIT(100),
             1          LYVAL(104),INDEX(16),XMIN(16),XMAX(16),
             1          RANGE(16)
0003          DATA LXLINE/124/,LYLINE/103*45/,
             1    LYSCAL/124,9*32,124,9*32,124,9*32,124,9*32,
             1          124,9*32,124,9*32,124,9*32,124,9*32,
             1          124,9*32,124,9*32,124/,
             1    LYVAL/'0',9*32,'1','0',8*32,'2','0',8*32,
             1          '3','0',8*32,'4','0',8*32,'5','0',8*32,
             1          '6','0',8*32,'7','0',8*32,'8','0',8*32,
             1          '9','0',8*32,'1','0','0',' '/,
             1    LYTIT/43*32,'Y',' ','A','X','I','S',' ','P','E',
             1         'R','C','E','N','T',43*32/,
             1    LVARC/82,80,89,112,114,97,
             1         84,118,104,122,121,5*42/,
             1     IESCAP/27/,LTY/121/,IVNUM/16*1/,
             1     INDEX/5,9,13,15,17,19,20,21,22,23,24,5*0/
0004          PAUSE 'READY LINE PRINTER AND HIT CONTINUE'
0005          PAUSE 'INSERT DATA DISC IN UNIT ONE (DK1) AND HIT RETURN'
0006          WRITE(7,7000)
0007          CALL ASSIGN(2,'LP:',-1,'RDO','NC',1)
0008          WRITE(7,7010)
0009          READ(5,5010) (LHEAD(I),I=1,60)
0010          WRITE(7,7030)
0011          READ(5,5030) (IVNUM(I),I=1,11)
0012          WRITE(7,7035)
0013          READ(5,5035) ISBJCT
0014          WRITE(7,7036)
0015          READ(5,5036) IUNIT
0016          WRITE(7,7037)
0017          READ(5,5037) IBEGIN
0018          CALL SCALE(IBDATA,XMIN,XMAX,MARK,RANGE,INDEX,ISBJCT)
0019          IF(MARK.EQ.0) GO TO 999
0021          WRITE(IUNIT,6010)
0022          WRITE(IUNIT,6020) (LHEAD(I),I=1,60)
0023          WRITE(IUNIT,6030)
0024          DO 10 I=1,11
0025          IF(IVNUM(I).NE.1) GO TO 10
0027          WRITE(IUNIT,6040) I,INDEX(I),XMIN(I),XMAX(I),RANGE(I)
0028       10 CONTINUE
0029          WRITE(IUNIT,6060) (I,LVARC(I),I=1,11)
0030          NBLOCK=0
0031          IXLOC=0
0032          ISPRNT=0
0033      100 CONTINUE
0034          CALL INPUT(IBDATA,NBLOCK,MARK,2)
```

Program Listing STRPLT (Continued)



```
FORTRAN IV      H01A-1    FRI 08-MAY-81 08:05:09              PAGE 002

          IF(MARK.EQ.0) GO TO 800
          IF(MARK.EQ.-2) GO TO 810
          IF(NBLOCK.NE.1) GO TO 120
          WRITE(IUNIT,6410)
          DO 115 I=1,10
          IF(IBDATA(1,I).NE.ISBJCT) GO TO 115
          DO 110 J=1,11
          ISUB=INDEX(J)
          WRITE(IUNIT,6400) J,ISUB,IBDATA(ISUB,I)
      110 CONTINUE
          GO TO 116
      115 CONTINUE
      116 CONTINUE
          WRITE(IUNIT,6061)
          IF(IUNIT.EQ.7) GO TO 120
          WRITE(6,6050) IESCAP,LTY
          WRITE(6,6070) (LHEAD(I),I=1,60)
          WRITE(6,6080) (LYTIT(I),I=1,100)
          WRITE(6,6090) (LYVAL(I),I=1,104)
          WRITE(6,6100) (LYSCAL(I),I=1,101)
          WRITE(6,6110) (LYLINE(I),I=1,103)
      120 CONTINUE
          DO 300 I=1,10
          IF(IBDATA(1,I).NE.ISBJCT) GO TO 300
          ISPRNT=ISPRNT+1
          IXLOC=IXLOC+1
          DO 220 J=1,100
          LPCHAR(J)=32
      220 CONTINUE
          DO 260 K=1,11
          IF(IVNUM(K).NE.1) GO TO 260
          ISUB=INDEX(K)
          IVALUE=IBDATA(ISUB,I)
          IF(ISUB.EQ.22) IVALUE=IABS(IVALUE)
          RVALUE=ABS(FLOAT(IVALUE)-XMIN(K)+1.0)
          YLOC=RVALUE/RANGE(K)*100.0+0.5
          IF(IUNIT.EQ.7) YLOC=YLOC/2.0
          IYLOC=IFIX(YLOC)
          IF(IYLOC.GT.100) IYLOC=100
          IF((IUNIT.EQ.7).AND.(IYLOC.GT.50)) IYLOC=50
          IF(IYLOC.LT.1) IYLOC=1
          IF(IXLOC.LT.IBEGIN) GO TO 230
          IF(IUNIT.EQ.7) GO TO 230
          WRITE(7,7300) NBLOCK,I,K,IBDATA(4,I),IVALUE,IXLOC,IYLOC
      230 CONTINUE
          IF(LPCHAR(IYLOC).EQ.32) LPCHAR(IYLOC)=LVARC(K)
          IF(ISUB.NE.22) GO TO 260
          IF((IHSAVE.LT.0).AND.(IBDATA(ISUB,I).GE.0))
         1 LPCHAR(IYLOC)=43
          IF((IHSAVE.GE.0).AND.(IBDATA(ISUB,I).LT.0))
         1 LPCHAR(IYLOC)=45
          IHSAVE=IBDATA(ISUB,I)
      260 CONTINUE
          LXSCAL=32
```

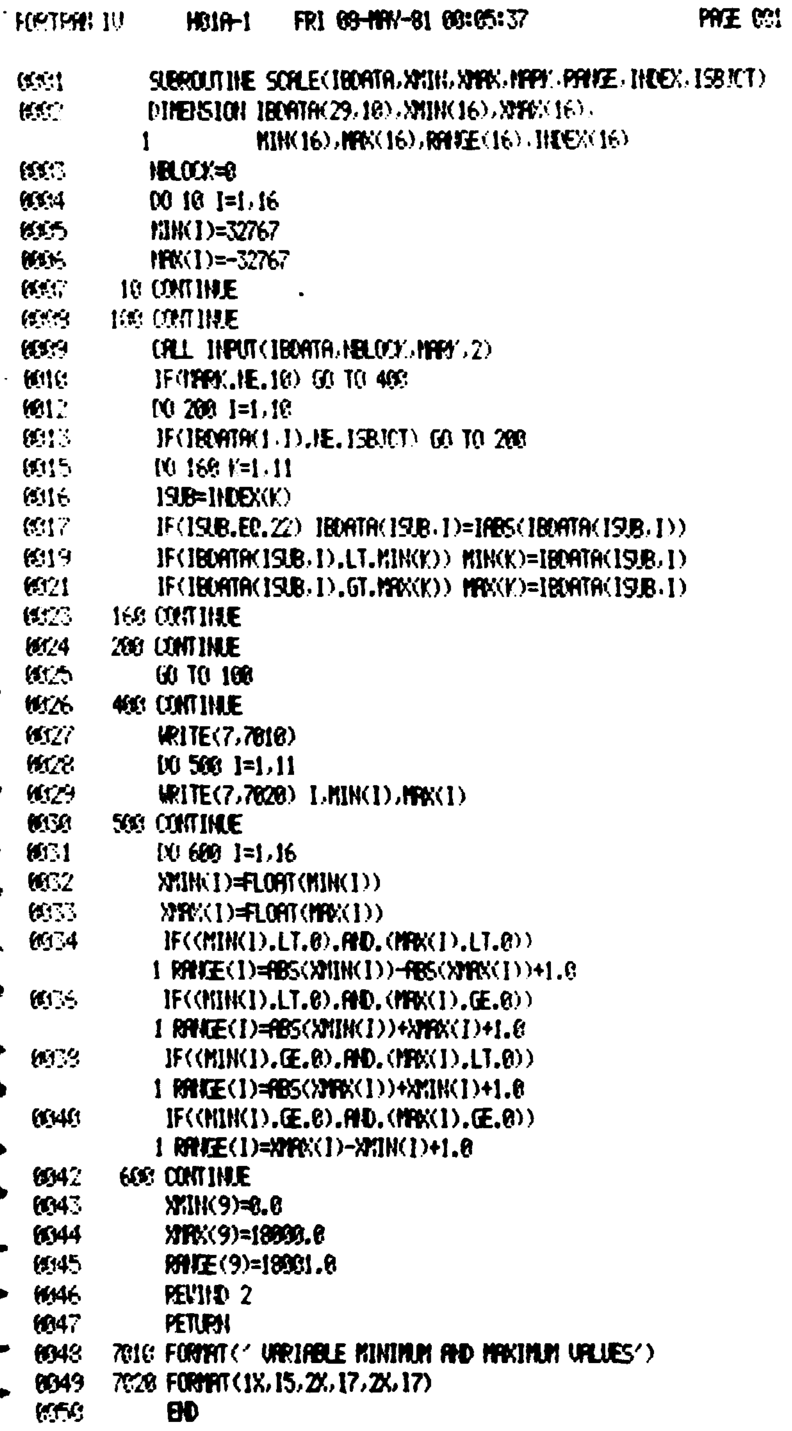
Program Listing STRPLT (Continued)

```
FORTRAN IV      H01A-1    FRI 08-MAY-81 00:05:09              PAGE 003

            IF(ISPRNT.EQ.10) LXSCAL=45
            IF(ISPRNT.EQ.10) ISPRNT=0
            IF(IXLOC.LT.IBEGIN) GO TO 300
            IF(IUNIT.EQ.7) GO TO 270
            WRITE(6,6120) IBDATA(3,I),IBDATA(2,I),IBDATA(4,I),
           1              LXSCAL,LXLINE,(LPCHAR(IJKL),IJKL=1,100),
           1              LXLINE,LXSCAL,IBDATA(4,I),IXLOC
            GO TO 300
      270   CONTINUE
            WRITE(7,7120) IBDATA(3,I),IBDATA(2,I),IBDATA(4,I),IXLOC,
           1              LXSCAL,LXLINE,(LPCHAR(IJKL),IJKL=1,50),
           1              LXLINE,LXSCAL
      300   CONTINUE
            GO TO 100
      800   CONTINUE
            WRITE(6,7100)
            GO TO 820
      810   CONTINUE
            IF(IUNIT.EQ.7) GO TO 820
            WRITE(6,6110) (LYLINE(I),I=1,103)
            WRITE(6,6100) (LYSCAL(I),I=1,101)
            WRITE(6,6090) (LYVAL(I),I=1,104)
            WRITE(6,6091) (LYTIT(I),I=1,100)
            WRITE(6,6070) (LHEAD(I),I=1,60)
      820   CONTINUE
            CALL CLOSE(2)
            STOP 'END OF PROGRAM STRPLT.FOR'
     5010   FORMAT(60A1)
     5030   FORMAT(11I7)
     5035   FORMAT(I7)
     5036   FORMAT(I7)
     5037   FORMAT(I7)
     7000   FORMAT(' NAME THE INPUT FILE (ASSIGN TO DK:)'/)
     7010   FORMAT(' ENTER TITLE FOR PLOT (60A1 MAX)')
     7030   FORMAT(' ENTER FLAG FOR THE ELEVEN VARIABLES (11I7)')
     7035   FORMAT(' ENTER STUDENT NUMBER (I)')
     7036   FORMAT(' ENTER OUTPUT UNIT NUMBER (LP:=6,TT:=7)')
     7037   FORMAT(' ENTER BEGINING LOCATION OF PLOT (I)')
     7100   FORMAT(' READ ERROR IN INPUT FILE')
     7300   FORMAT(1X,7I7)
     6010   FORMAT(' ',5X,'C-50 STRIP PLOTTER ROUTINE'/
           1 6X,'ARMY RESEARCH INSTITUTE, FORT RUCKER FIELD UNIT'/
           1 6X,'MULTIVARIATE ANALYSIS OF TIME SEQUENCED DATA'/
           1 6X,'UH-1 (HUEY) STUDENT PILOT SIMULATOR SESSIONS'/' ')
     6020   FORMAT(' ',5X,'TITLE: ',60A1)
     6030   FORMAT(' '/' ',5X,'VARIABLE SCALES:'/' '/
           1 ' ',5X,'INDEX',3X,'SUB',
           1 2X,'MINIMUM',2X,'MAXIMUM',6X,'RANGE'/
           1 ' ',5X,'-----',3X,'---',
           1 2X,'-------',2X,'-------',6X,'-----'/' ')
     6040   FORMAT(6X,I5,2X,I4,2X,F7.0,2X,F7.0,2X,F9.0)
     6050   FORMAT(1X,2A1/'1')
     6060   FORMAT(' '/' '/
           1 ' ',5X,'VARIABLE KEYS:'/' '/
```

Program Listing STRPLT (Concluded)

```
              1 ' ',5X,'INDEX',2X,'CHAR',2X,'DESCRIPTION'/
              1 ' ',5X,'-----',2X,'----',2X,'-----------'/' '/
              1 6X,I5,2X,A1,5X,'STICK X (ROLL INPUT)'/
              1 6X,I5,2X,A1,5X,'STICK Y (PITCH INPUT)'/
              1 6X,I5,2X,A1,5X,'PEDAL POSITON'/
              1 6X,I5,2X,A1,5X,'PITCH'/
              1 6X,I5,2X,A1,5X,'ROLL'/
              1 6X,I5,2X,A1,5X,'ALTITUDE'/
              1 6X,I5,2X,A1,5X,'TORQUE'/
              1 6X,I5,2X,A1,5X,'AIRSPEED'/
              1 6X,I5,2X,A1,5X,'HEADING'/
              1 6X,I5,2X,A1,5X,'VERTICAL VELOCITY'/
              1 6X,I5,2X,A1,5X,'YAW'/' ')
 0152   6051 FORMAT(1X/6X,'NOTE 1: ALL SCALES RELATIVE EXCEPT HEADING'/
              1 6X,'NOTE 2: VARIABLES SAMPLED ONCE EVERY TWO SECONDS'/
              1 6X,'NOTE 3: SYMBOL "+" INDICATES HEADING HAS',
              1 ' CHANGED FROM NEGATIVE TO POSITIVE'/
              1 6X,'NOTE 4: SYMBOL "-" INDICATES HEADING HAS',
              1 ' CHANGED FROM POSITIVE TO NEGATIVE'/' ')
 0153   6070 FORMAT(18X,60A1/1X/1X)
 0154   6090 FORMAT(18X,100A1/1X)
 0155   6091 FORMAT(1X/18X,100A1/1X)
 0156   6080 FORMAT(17X,104A1)
 0157   6100 FORMAT(17X,101A1)
 0158   6110 FORMAT(16X,103A1)
 0159   6120 FORMAT(4X,I2,I5,I4,1X,104A1,I4,I6)
 0160   7120 FORMAT(1X,I3,1X,I5,1X,I5,1X,I5,4X,54A1)
 0161   6410 FORMAT(6X,'INTIAL VALUES:'/1X/
              1 6X,'INDEX',2X,'SUB',4X,'VALUE'/
              1 6X,'-----',2X,'---',4X,'-----'/' ')
 0162   6400 FORMAT(6X,I5,2X,I3,2X,I7)
 0163        END
```

Subroutine SCALE



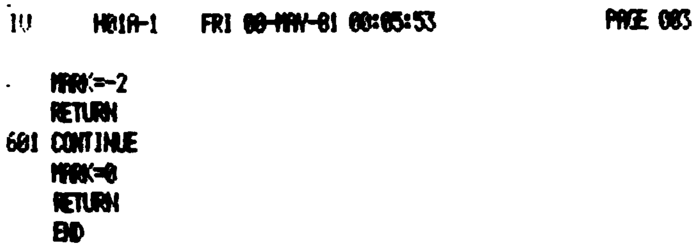
```
FORTRAN IV      H01A-1    FRI 08-MAY-81 00:05:37              PAGE 001

      SUBROUTINE SCALE(IBDATA,XMIN,XMAX,MARK,RANGE,INDEX,ISBJCT)
      DIMENSION IBDATA(29,10),XMIN(16),XMAX(16),
     1          MIN(16),MAX(16),RANGE(16),INDEX(16)
      NBLOCK=0
      DO 10 I=1,16
      MIN(I)=32767
      MAX(I)=-32767
   10 CONTINUE
  100 CONTINUE
      CALL INPUT(IBDATA,NBLOCK,MARK,2)
      IF(MARK.NE.10) GO TO 400
      DO 200 I=1,10
      IF(IBDATA(1,I).NE.ISBJCT) GO TO 200
      DO 160 K=1,11
      ISUB=INDEX(K)
      IF(ISUB.EQ.22) IBDATA(ISUB,I)=IABS(IBDATA(ISUB,I))
      IF(IBDATA(ISUB,I).LT.MIN(K)) MIN(K)=IBDATA(ISUB,I)
      IF(IBDATA(ISUB,I).GT.MAX(K)) MAX(K)=IBDATA(ISUB,I)
  160 CONTINUE
  200 CONTINUE
      GO TO 100
  400 CONTINUE
      WRITE(7,7010)
      DO 500 I=1,11
      WRITE(7,7020) I,MIN(I),MAX(I)
  500 CONTINUE
      DO 600 I=1,16
      XMIN(I)=FLOAT(MIN(I))
      XMAX(I)=FLOAT(MAX(I))
       IF((MIN(I).LT.0).AND.(MAX(I).LT.0))
     1 RANGE(I)=ABS(XMIN(I))-ABS(XMAX(I))+1.0
       IF((MIN(I).LT.0).AND.(MAX(I).GE.0))
     1 RANGE(I)=ABS(XMIN(I))+XMAX(I)+1.0
       IF((MIN(I).GE.0).AND.(MAX(I).LT.0))
     1 RANGE(I)=ABS(XMAX(I))+XMIN(I)+1.0
       IF((MIN(I).GE.0).AND.(MAX(I).GE.0))
     1 RANGE(I)=XMAX(I)-XMIN(I)+1.0
  600 CONTINUE
      XMIN(9)=0.0
      XMAX(9)=18000.0
      RANGE(9)=18001.0
      REWIND 2
      RETURN
 7010 FORMAT(' VARIABLE MINIMUM AND MAXIMUM VALUES')
 7020 FORMAT(1X,I5,2X,I7,2X,I7)
      END
```

Subroutine INPUT

```
FORTRAN IV      H01A-1    FRI 08-MAY-81 08:05:53               PAGE 001

      SUBROUTINE INPUT(X,NBLOCK,MARK,N)
      INTEGER DATA,X
      DIMENSION DATA(250),X(29,10)
      IP=0
      IPL=0
      DO 10 J=1,10
      DO 10 I=1,29
      X(I,J)=0
   10 CONTINUE
      MARK=0
      READ(N,END=501,ERR=601) IDUM1,IDUM2,IDUM3,IDUM4,IDUM5,IDUM6,
     1                        (DATA(I),I=1,250)
      NBLOCK=NBLOCK+1
      K=0
C MAIN LOOP
      DO 100 J=1,10
      K=K+2
C STUDENT NUMBER
      X(1,J)=DATA(K)
C PERIOD
      K=K+2
      X(2,J)=MOD(DATA(K),256)
C SEGMENT NUMBER
      K=K+10
      DO 20 I=1,2
      K=K+1
      NTY=MOD(DATA(K),2)
      X(3,J)=X(3,J)+NTY
      DATA(K)=DATA(K)-NTY
   20 CONTINUE
C TIME
      K=K-12
   30 LPS=DATA(K)/256+IP
      IF(IPL.LT.LPS) GO TO 40
      IP=IP+256
      GO TO 30
   40 IPL=LPS
      X(4,J)=LPS
C STICK X (ROLL INPUT) SCALING IS INCHES TIMES 100 MAX=6.24"
      DO 50 I=5,8
      K=K+1
      Y=FLOAT(DATA(K))*0.019044+ISIGN(5,DATA(K))/10.0
      X(I,J)=INT(Y)
   50 CONTINUE
C STICK Y (PITCH INPUT) SCALING IS INCHES TIMES 100 MAX=6.333"
      DO 60 I=9,12
      K=K+1
      Y=FLOAT(DATA(K))*0.019323+ISIGN(5,DATA(K))/10.0
      X(I,J)=INT(Y)
   60 CONTINUE
      DO 70 I=13,14
      K=K+1
C SIDE TASK START FLAG
      NTY=MOD(DATA(K),2)
```

```
FORTRAN IV      HD1A-1    FRI 08-MAY-81 00:05:53              PAGE 002

0047         DATA(K)=DATA(K)-NTY
0048         X(26,J)=X(26,J)+100*NTY
       C PEDAL POSTION SCALING IS INCHES TIMES 100 MAX=3.25"
0049         Y=FLOAT(DATA(K))*0.009919+ISIGN(5,DATA(K))/10.0
0050         X(I,J)=INT(Y)
0051      70 CONTINUE
       C PITCH INDICATED MAX=60 DEGREES, SCALED TIMES 100
0052         DO 80 I=15,16
0053         K=K+1
0054         DATA(K)=DATA(K)-MOD(DATA(K),2)
0055         Y=FLOAT(DATA(K))*0.54935+ISIGN(5,DATA(K))/10.0
0056         X(I,J)=INT(Y)
0057      80 CONTINUE
       C ROLL INDICATED MAX=90 DEGREES, SCALED TIMES 100
0058         DO 90 I=17,18
0059         K=K+1
0060         DATA(K)=DATA(K)-MOD(DATA(K),2)
0061         Y=FLOAT(DATA(K))*0.54932+ISIGN(5,DATA(K))/10.0
0062         X(I,J)=INT(Y)
0063      90 CONTINUE
       C ALTITUDE
0064         K=K+1
0065         X(19,J)=DATA(K)
       C TORQUE   0 TO 100 PSI
0066         K=K+1
0067         X(20,J)=DATA(K)/256
       C AIRSPEED MAX=146.5 KNOTS, SCALED TIMES 100
0068         X(21,J)=6*MOD(DATA(K),256)
       C HEADING 0 TO 360 DEGREES, SCALED TIMES 100
0069         K=K+1
0070         X(22,J)=FLOAT(DATA(K))*0.54932+ISIGN(5,DATA(K))/10.0
       C VERTICAL VELOCITY
0071         K=K+1
0072         X(23,J)=DATA(K)
       C YAW 0 TO 14.9 DEGREES, SCALED TIMES 100
0073         K=K+1
0074         X(24,J)=FLOAT(DATA(K))*0.04540+ISIGN(5,DATA(K))/100.0
       C COURSE DEVIATION
0075         K=K+1
0076         X(25,J)=FLOAT(DATA(K))*0.54932+ISIGN(5,DATA(K))/10.0
       C SIDE TASK NUMBER
0077         K=K-21
0078         X(26,J)=X(26,J)+MOD(DATA(K),256)
       C GENERATOR RECYCLE TIME
0079         X(29,J)=DATA(K)/256
       C STATION SELECT TIME
0080         K=K+22
0081         X(27,J)=DATA(K)/256
       C MIKE RESPONSE TIME
0082         X(28,J)=MOD(DATA(K),256)
0083     100 CONTINUE
0084         MARK=10
0085         RETURN
0086     501 CONTINUE
```

Subroutine INPUT (Concluded)



```
 IU     H01A-1    FRI 08-MAY-81 08:05:53              PAGE 003

      MARK=-2
      RETURN
  601 CONTINUE
      MARK=0
      RETURN
      END
```

Table 5

STRPLT.FOR

Strip Plot	
Purpose: To plot flight variables on the line printer.	
Computer Output	User Input
	● Run STRPLT
Pause -- Ready line printer and hit continue	⟨CR⟩
Pause -- Insert data disc in unit one (DK:) and hit return	⟨CR⟩
Name the input file (assign to DK:)	*DK: F17932. DAT ⟨CR⟩
Enter title for plot (goal Max)	Subject 17932 ⟨CR⟩
Enter flag for the eleven variables (11I7)	0,0,0,1,1,1,0,1,1,0,0[1] ⟨CR⟩
Enter student number (I)	17932 ⟨CR⟩

0 = Unwanted variables
1 = Desired variables

Table 5

STRPLT.FOR (Concluded)

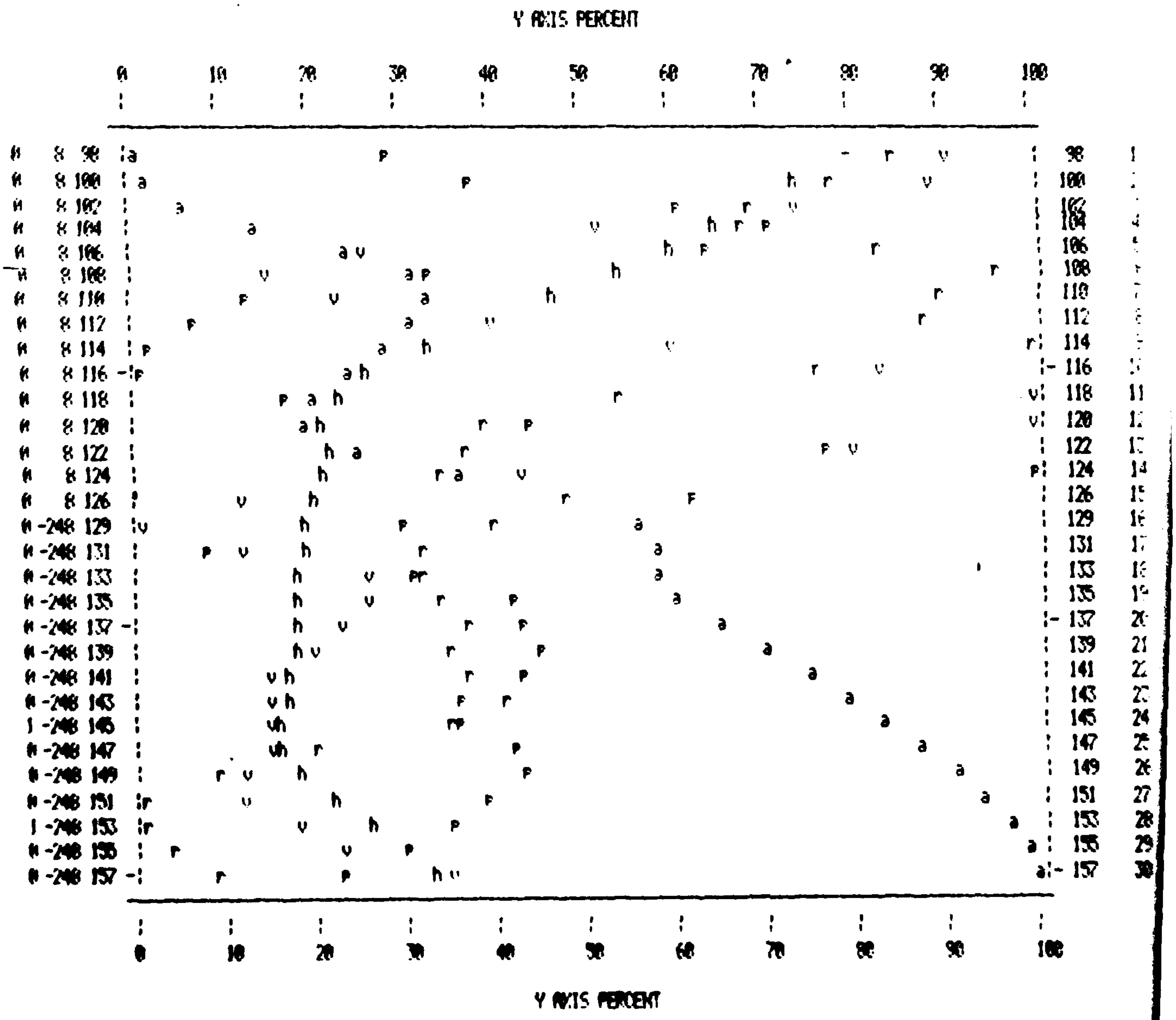
Strip Plot	
Computer Output	Computer Input
Enter output unit number (LP: = 6[2], TT: = 7)[3]	6 ⟨CR⟩
Enter beginning location of plot	0 ⟨CR⟩
[2] LP = Line printer [3] TT = teletype	

Example Output STRPLT

```
C-50 STRIP PLOTTER ROUTINE
ARMY RESEARCH INSTITUTE, FORT RUCKER FIELD UNIT
MULTIVARIATE ANALYSIS OF TIME SEQUENCED DATA
UH-1 (HUEY) STUDENT PILOT SIMULATOR SESSIONS

TITLE: SUBJECT 9933

VARIABLE SCALES:

INDEX   SUB  MINIMUM  MAXIMUM      RANGE
-----   ---  -------  -------      -----

    4   15    -305.    1665.       1971.
    5   17   -1581.    3231.       4813.
    6   19     991.    1496.        506.
    8   21     768.     978.        211.
    9   22       0.   18000.      18001.


 VARIABLE KEYS:

 INDEX  CHAR  DESCRIPTION
 -----  ----  -----------

     1  R     STICK X (ROLL INPUT)
     2  P     STICK Y (PITCH INPUT)
     3  Y     PEDAL POSITON
     4  p     PITCH
     5  r     ROLL
     6  a     ALTITUDE
     7  T     TORQUE
     8  v     AIRSPEED
     9  h     HEADING
    10  z     VERTICAL VELOCITY
    11  y     YAW

  INTIAL VALUES:

  INDEX SUB    VALUE
  ----- ---    -----

      1   5     -112
      2   9      246
      3  13      -38
      4  15      271
      5  17     2465
      6  19      991
      7  20       28
      8  21      960
      9  22   -14421
     10  23      210
     11  24       10

   NOTE 1: ALL SCALES RELATIVE EXCEPT HEADING
   NOTE 2: VARIABLES SAMPLED ONCE EVERY TWO SECONDS
   NOTE 3: SYMBOL "+" INDICATES HEADING HAS CHANGED FROM NEGATIVE TO POSITIVE
   NOTE 4: SYMBOL "-" INDICATES HEADING HAS CHANGED FROM POSITIVE TO NEGATIVE
```

Example Output STRPLT (Concluded)

SUBJECT 9933

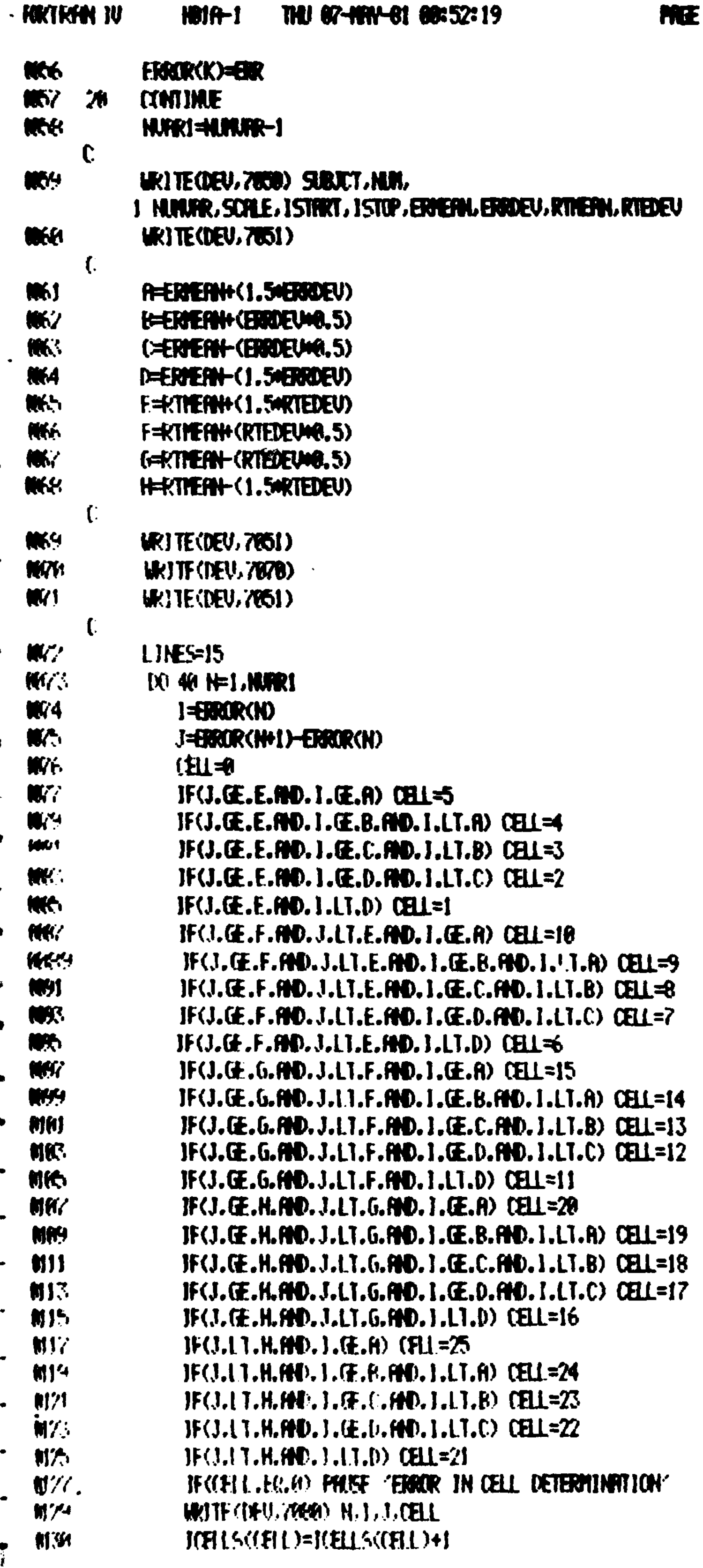


SUBJECT 9933

Program Listing PHAN 3

```
FORTRAN IV      V01A-1    THU 07-MAY-81 08:52:19                PAGE 001

C     PROGRAM: PHAN3.FOR
C     PURPOSE: RETURNS CELL VALUES FOR C-50 FLIGHT DATA
C     CONTRACT: C-50
C     DATE: 21-FEB-81
C
      COMMON VARBLE(3000),ERROR(3000)
      DIMENSION ICELLS(25),ITMATX(25,25),KSTART(100),
     1KSTOP(100),AMEANK(4,100)
       INTEGER VARBLE,SUBJCT,NUMVAR,NUM,SUB1,SUB2,SUB3,DEV,CELL,CELLM1
      REAL I,J,CHKVAL,ERMEAN
      DATA TOTERR,TOTSQR,ERRSQR,ERMEAN/0.0,0.0,0.0,0.0/
      DATA RATERR,TOTRTE,RTESQR,ERRSQR/0.0,0.0,0.0,0.0/
      DATA SUB1,SUB2,SUB3,NUMVAR/0,0,0,0/
      DATA ICELLS/25*0/,ITMATX/625*0/
C
   17 CONTINUE
      PAUSE' HIT RETURN & NAME OUTPUT FILE'
      CALL ASSIGN(1,' ',-1,'NEW','NC',1)
      PAUSE' INSERT DATA DISC IN DRIVE ONE AND HIT RETURN'
      PAUSE' HIT RETURN AND NAME THE 1ST INPUT FILE'
      CALL ASSIGN(2,' ',-1,'RDO','NC',1)
      WRITE(7,7022)
      READ(5,5022)SUBJCT
      WRITE(7,7000)
      READ(5,5000)CHKVAL
       WRITE(7,7023)
       READ(5,5023)ERMEAN,ERRDEV,RTMEAN,RTEDEV
      WRITE(7,7010)
      READ(5,5010) NUM
      IF(NUM.EQ.21) SCALE=10.0
      IF(NUM.EQ.19) SCALE=1.0
      IF(NUM.EQ.22) SCALE=100.0
      IF(NUM.EQ.23) SCALE=1.0
      WRITE(7,7020)
      READ(5,5020) DEV
   10    DO 21 II=1,100
      READ(2,5021)KSTART(II),KSTOP(II),(AMEANK(JJ,II),JJ=1,4)
       IF(KSTART(II).LE.0)GO TO 22
   21 CONTINUE
   22 ILIST=II-1
      CALL CLOSE(2)
      PAUSE'HIT RETURN & NAME 2ND INPUT FILE'
      CALL ASSIGN(2,' ',-1,'RDO','NC',1)
      DO 23 II=1,ILIST
      IF(NUM.EQ.19) ERMEAN=AMEANK(1,II)
      IF(NUM.EQ.21) ERMEAN=AMEANK(2,II)
      IF(NUM.EQ.22) ERMEAN=AMEANK(3,II)
      IF(NUM.EQ.23) ERMEAN=AMEANK(4,II)
      ISTART=KSTART(II)
      ISTOP=KSTOP(II)
      CALL READ1(NUM,NUMVAR,ISTART,ISTOP,SUBJCT)
C
      DO 20 K=1,NUMVAR
      ERR=(FLOAT(VARBLE(K))/SCALE)-CHKVAL-ERMEAN
```

Program Listing PHAN 3 (Continued)



```
FORTRAN IV      V01A-1    THU 07-MAY-81 08:52:19              PAGE 002

              ERROR(K)=ERR
        20    CONTINUE
              NVAR1=NUMVAR-1
      C
              WRITE(DEV,7050) SUBJCT,NUM,
             1 NUMVAR,SCALE,ISTART,ISTOP,ERMEAN,ERRDEV,RTMEAN,RTEDEV
              WRITE(DEV,7051)
      C
              A=ERMEAN+(1.5*ERRDEV)
              B=ERMEAN+(ERRDEV*0.5)
              C=ERMEAN-(ERRDEV*0.5)
              D=ERMEAN-(1.5*ERRDEV)
              E=RTMEAN+(1.5*RTEDEV)
              F=RTMEAN+(RTEDEV*0.5)
              G=RTMEAN-(RTEDEV*0.5)
              H=RTMEAN-(1.5*RTEDEV)
      C
              WRITE(DEV,7051)
              WRITE(DEV,7070)
              WRITE(DEV,7051)
      C
              LINES=15
              DO 40 N=1,NVAR1
                 I=ERROR(N)
                 J=ERROR(N+1)-ERROR(N)
                 CELL=0
                 IF(J.GE.E.AND.I.GE.A) CELL=5
                 IF(J.GE.E.AND.I.GE.B.AND.I.LT.A) CELL=4
                 IF(J.GE.E.AND.I.GE.C.AND.I.LT.B) CELL=3
                 IF(J.GE.E.AND.I.GE.D.AND.I.LT.C) CELL=2
                 IF(J.GE.E.AND.I.LT.D) CELL=1
                 IF(J.GE.F.AND.J.LT.E.AND.I.GE.A) CELL=10
                 IF(J.GE.F.AND.J.LT.E.AND.I.GE.B.AND.I.LT.A) CELL=9
                 IF(J.GE.F.AND.J.LT.E.AND.I.GE.C.AND.I.LT.B) CELL=8
                 IF(J.GE.F.AND.J.LT.E.AND.I.GE.D.AND.I.LT.C) CELL=7
                 IF(J.GE.F.AND.J.LT.E.AND.I.LT.D) CELL=6
                 IF(J.GE.G.AND.J.LT.F.AND.I.GE.A) CELL=15
                 IF(J.GE.G.AND.J.LT.F.AND.I.GE.B.AND.I.LT.A) CELL=14
                 IF(J.GE.G.AND.J.LT.F.AND.I.GE.C.AND.I.LT.B) CELL=13
                 IF(J.GE.G.AND.J.LT.F.AND.I.GE.D.AND.I.LT.C) CELL=12
                 IF(J.GE.G.AND.J.LT.F.AND.I.LT.D) CELL=11
                 IF(J.GE.H.AND.J.LT.G.AND.I.GE.A) CELL=20
                 IF(J.GE.H.AND.J.LT.G.AND.I.GE.B.AND.I.LT.A) CELL=19
                 IF(J.GE.H.AND.J.LT.G.AND.I.GE.C.AND.I.LT.B) CELL=18
                 IF(J.GE.H.AND.J.LT.G.AND.I.GE.D.AND.I.LT.C) CELL=17
                 IF(J.GE.H.AND.J.LT.G.AND.I.LT.D) CELL=16
                 IF(J.LT.H.AND.I.GE.A) CELL=25
                 IF(J.LT.H.AND.I.GE.B.AND.I.LT.A) CELL=24
                 IF(J.LT.H.AND.I.GE.C.AND.I.LT.B) CELL=23
                 IF(J.LT.H.AND.I.GE.D.AND.I.LT.C) CELL=22
                 IF(J.LT.H.AND.I.LT.D) CELL=21
                 IF(CELL.EQ.0) PAUSE 'ERROR IN CELL DETERMINATION'
                 WRITE(DEV,7080) N,I,J,CELL
                 ICELLS(CELL)=ICELLS(CELL)+1
```

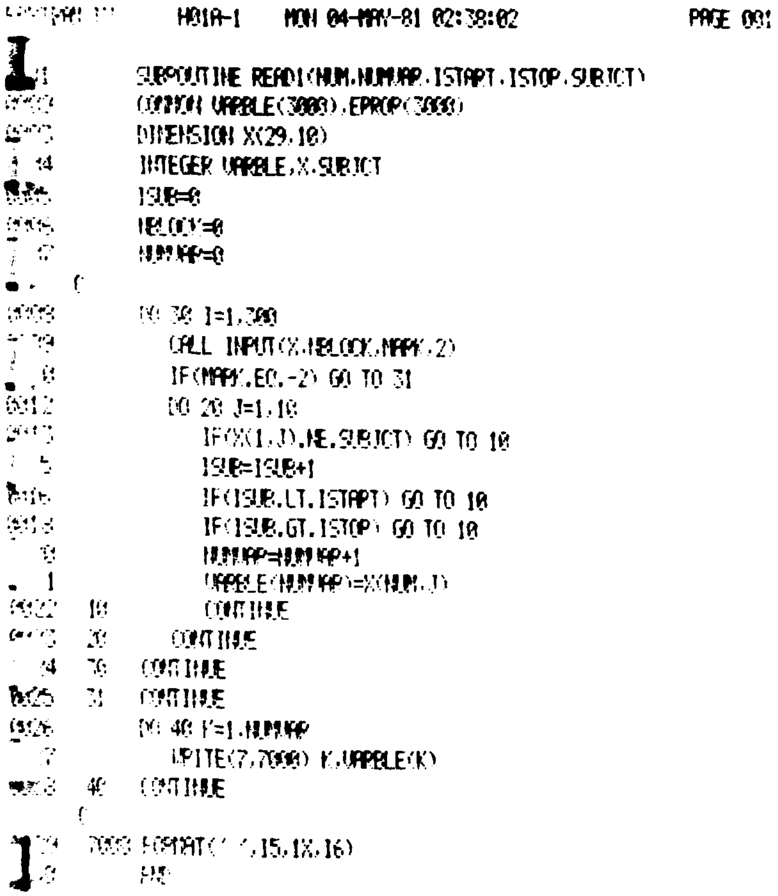
Program Listing PHAN 3 (Continued)

```
FORTRAN IV      H01A-1    THU 07-MAY-81 08:52:19            PAGE 003

                IF(N.LT.2) CELLM1=CELL
                IF(N.LT.2) GO TO 39
                ITMATX(CELLM1,CELL)=ITMATX(CELLM1,CELL)+1
                CELLM1=CELL
        39      CONTINUE
                LINES=LINES+1
                IF(LINES.LT.45) GOTO 40
                  LINES=0
                  WRITE(DEV,7071)
        40   CONTINUE
             REWIND 2
        23    CONTINUE
        11   WRITE(DEV,7090) (ICELLS(M),M=1,25)
             WRITE(DEV,7091) ((ITMATX(M,N),N=1,25),M=1,25)
             DO 90 M=1,25
        90   WRITE(1,5024)(ITMATX(M,N),N=1,25)
             CALL CLOSE(1)
             CALL CLOSE(DEV)
             STOP
       C
       5000  FORMAT(F13.7)
        5010 FORMAT(I6)
        5011 FORMAT(F13.7)
        5021 FORMAT(2I7,4F8.0)
        5020 FORMAT(I6)
        5022 FORMAT(I7)
        5023 FORMAT(4F15.4)
        5024 FORMAT(25I4)
        7000 FORMAT(' ENTER CHECK VALUE TO BE ANALYSED'/
            1          ' AIRSPEED-ENTER 90.00'/
            1          ' ALTITUDE-ENTER 2000.00'/
            1          ' HEADING -ENTER 90.00'/
            1          ' RATE OF CLIMB-ENTER 0.00'/)
        7010 FORMAT(' FOR THE VARIABLE TO BE ANALYZED:'/
            1          ' AIRSPEED - ENTER 21'/
            1          ' ALTITUDE - ENTER 19'/
            1          ' HEADING - ENTER 22'/
            1          ' RATE OF CLIMB - ENTER 23'/)
        7020 FORMAT(' FOR OUTPUT 6=LP 7=TT ')
        7021 FORMAT(' ENTER THE START AND STOP POSITION IN FILE, ENTER ERMEAN')
        7022 FORMAT(' ENTER SUBJECT NUMBER')
        7023 FORMAT('ENTER ERMEAN,ERRDEV,RTMEAN,RTEDEV')
        7050 FORMAT(' SUBJECT: ',I6/
            1          ' VARIABLE: ',I2/
            1          ' NUMBER OF SAMPLES: ',I5/
            1          ' VARIABLE SCALE: ',F10.5/
            1          ' START POSITION: ',I5/
            1          ' STOP POSTION: ',I5/
            1          ' MEAN OF ERROR = ',F14.4/
            1          ' ERROR DEVIATION = ',F14.4/
            1          ' MEAN OF ERROR RATE = ',F14.4/
            1          ' DEVIATION OF ERROR RATE = ',F14.4/)
        7051 FORMAT(' ')
        7060 FORMAT('   CELL VALUES '//
```

Program Listing PHAN 3 (Concluded)

```
HP'PHAN III      HASA-1    THU 07-MAY-81 08:52:19               PAGE 004

            1     '  ————+————+————+————+———— '/
            1     '   1     2     3     4     5   '/
            1     '  ————+————+————+————+———— +1.5
            1     '   6     7     8     9    10
            1     '  ————+————+————+————+- - -
            1     '   11    12    13    14    15      RATE OF ERROR
            1     '  ————+————+————+————+   -
            1     '   16    17    18    19    20
            1     '  ————+————+————+————+———— -1.5'/
            1     '   21    22    23    24    25
            1     '  ————+————+————+————+- - - -
            1     '      -1.5   -.5   +.5   +1.5
            1     '                ERROR'/)
     7070 FORMAT(' ','INDEX',5X,'ERROR',2X,'RATE OF ERROR',2X,'CELL'/)
     7071 FORMAT('1','INDEX',5X,'ERROR',2X,'RATE OF ERROR',2X,'CELL'/)
     7000 FORMAT(' ',I5,1X,F9.3,2X,F13.3,2X,I4)
     7090 FORMAT('1'//'   CELL VALUES '//
            1     '  ————+————+————+————+———— '/
            1 ' ',1X,5(1X,I5,1X)/
            1     '  ————+————+————+————+———— +1.5 '
            1 ' ',1X,5(1X,I5,1X)/
            1     '  ————+————+————+————+———— +.5 '/
            1 ' ',1X,5(1X,I5,1X),'   RATE OF ERROR'/
            1     '  ————+————+————+————+———— -.5 '/
            1 ' ',1X,5(1X,I5,1X)/
            1     '  ————+————+————+————+———— -1.5 '/
            1 ' ',1X,5(1X,I5,1X)/
            1     '  ————+————+————+————+———— '/
            1     '      -1.5   -.5   +.5   +1.5     '/
            1     '                ERROR'/)
     7091 FORMAT('1'/
            1 ' ','CELL TRANSTION MATRIX:'/
            1 25(' ',25I4/))
              END
```

Subroutine READ

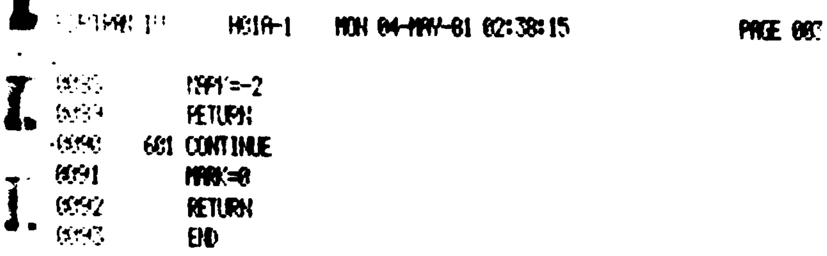


```
FORTRAN IV      H01A-1    MON 04-MAY-81 02:38:02              PAGE 001

            SUBROUTINE READ1(NUM,NUMVAR,ISTART,ISTOP,SUBJCT)
            COMMON VARBLE(3000),EPROP(3000)
            DIMENSION X(29,10)
            INTEGER VARBLE,X,SUBJCT
            ISUB=0
            NBLOCK=0
            NUMVAR=0
      C
            DO 30 I=1,300
               CALL INPUT(X,NBLOCK,MARK,2)
               IF(MARK.EQ.-2) GO TO 31
               DO 20 J=1,10
                  IF(X(1,J).NE.SUBJCT) GO TO 10
                  ISUB=ISUB+1
                  IF(ISUB.LT.ISTART) GO TO 10
                  IF(ISUB.GT.ISTOP) GO TO 10
                  NUMVAR=NUMVAR+1
                  VARBLE(NUMVAR)=X(NUM,J)
         10       CONTINUE
         20    CONTINUE
         30 CONTINUE
         31 CONTINUE
            DO 40 K=1,NUMVAR
               WRITE(7,7000) K,VARBLE(K)
         40 CONTINUE
      C
       7000 FORMAT(' ',I5,1X,I6)
            END
```

```
FORTRAN IV      V01A-1    MON 04-MAY-81 02:38:15             PAGE 001

          SUBROUTINE INPUT(X,NBLOCK,MARK,N)
          INTEGER DATA,X
          DIMENSION DATA(250),X(29,10)
          IP=0
          IPL=0
          DO 10 J=1,10
          DO 10 I=1,29
          X(I,J)=0
       10 CONTINUE
          MARK=0
          READ(N,END=501,ERR=601) IDUM1,IDUM2,IDUM3,IDUM4,IDUM5,IDUM6,
         1                        (DATA(I),I=1,250)
          NBLOCK=NBLOCK+1
          K=0
     C MAIN LOOP
          DO 100 J=1,10
          K=K+2
     C STUDENT NUMBER
          X(1,J)=DATA(K)
     C PERIOD
          K=K+2
          X(2,J)=MOD(DATA(K),256)
     C SEGMENT NUMBER
          K=K+10
          DO 20 I=1,2
          K=K+1
          NTK=MOD(DATA(K),2)
          X(3,J)=X(3,J)+NTK
          DATA(K)=DATA(K)-NTK
       20 CONTINUE
          K=K-12
       30 LPS=DATA(K)/256+IP
          IF(IPL.LT.LPS) GO TO 40
          IP=IP+256
          GO TO 30
       40 IPL=LPS
          X(4,J)=LPS
     C STICK X (ROLL INPUT) SCALING IS INCHES TIMES 100 MAX=6.24"
          DO 50 I=5,8
          K=K+1
          Y=FLOAT(DATA(K))*0.019044+ISIGN(5,DATA(K))/10.0
          X(I,J)=INT(Y)
       50 CONTINUE
     C STICK Y (PITCH INPUT) SCALING IS INCHES TIMES 100 MAX=6.333"
          DO 60 I=9,12
          K=K+1
          Y=FLOAT(DATA(K))*0.019323+ISIGN(5,DATA(K))/10.0
          X(I,J)=INT(Y)
       60 CONTINUE
          DO 70 I=13,14
          K=K+1
     C SIDE TASK START FLAG
          NTK=MOD(DATA(K),2)
          DATA(K)=DATA(K)-NTK
```

```
FORTRAN IV      H01A-1    MON 04-MAY-81 02:38:15              PAGE 002

               X(26,J)=X(26,J)+100*NTK
         C PEDAL POSTION SCALING IS INCHES TIMES 100 MAX=3.25"
               Y=FLOAT(DATA(K))*0.009919+ISIGN(5,DATA(K))/10.0
               X(I,J)=INT(Y)
            70 CONTINUE
         C PITCH INDICATED MAX=60 DEGREES, SCALED TIMES 100
               DO 80 I=15,16
               K=K+1
               DATA(K)=DATA(K)-MOD(DATA(K),2)
               Y=FLOAT(DATA(K))*0.54935+ISIGN(5,DATA(K))/10.0
               X(I,J)=INT(Y)
            80 CONTINUE
         C ROLL INDICATED MAX=90 DEGREES, SCALED TIMES 100
               DO 90 I=17,18
               K=K+1
               DATA(K)=DATA(K)-MOD(DATA(K),2)
               Y=FLOAT(DATA(K))*0.54932+ISIGN(5,DATA(K))/10.0
               X(I,J)=INT(Y)
            90 CONTINUE
         C ALTITUDE
               K=K+1
               X(19,J)=DATA(K)
         C TORQUE   0 TO 100 PSI
               K=K+1
               X(20,J)=DATA(K)/256
         C AIRSPEED MAX=146.5 KNOTS, SCALED TIMES 100
               X(21,J)=6*MOD(DATA(K),256)
         C HEADING 0 TO 360 DEGREES, SCALED TIMES 100
               K=K+1
               X(22,J)=FLOAT(DATA(K))*0.54932+ISIGN(5,DATA(K))/10.0
         C VERTICAL VELOCITY
               K=K+1
               X(23,J)=DATA(K)
         C YAW 0 TO 14.9 DEGREES, SCALED TIMES 100
               K=K+1
               X(24,J)=FLOAT(DATA(K))*0.04548+ISIGN(5,DATA(K))/100.0
         C COURSE DEVIATION
               K=K+1
               X(25,J)=FLOAT(DATA(K))*0.54932+ISIGN(5,DATA(K))/10.0
         C SIDE TASK NUMBER
               K=K-21
               X(26,J)=X(26,J)+MOD(DATA(K),256)
         C GENERATOR RECYCLE TIME
               X(29,J)=DATA(K)/256
         C STATION SELECT TIME
               K=K+22
               X(27,J)=DATA(K)/256
         C MIKE RESPONSE TIME
               X(28,J)=MOD(DATA(K),256)
           100 CONTINUE
               MARK=10
               RETURN
           501 CONTINUE
               REWIND 2
```

Subroutine INPUT (Concluded)



```
FORTRAN IV       H01A-1    MON 04-MAY-81 02:38:15              PAGE 003

                 MARK=-2
                 RETURN
             601 CONTINUE
                 MARK=0
                 RETURN
                 END
```

Table 6

PHAN3.FOR

<table>
<tr><th colspan="2">Return Cell Values for Flight Data</th></tr>
<tr><td colspan="2">Purpose: The user enters error mean, error deviation, mean error rate, and the deviation of the error rate. The computer reads the data file and computes phase plane cells and outputs a count matrix.</td></tr>
<tr><th>Computer Output</th><th>User Input</th></tr>
<tr><td></td><td>● Run PHAN 3
&lt;CR&gt;</td></tr>
<tr><td>Pause -- Hit return and name output file</td><td>&lt;CR&gt;
*DK:TTEST1.DAT
&lt;CR&gt;</td></tr>
<tr><td>Pause -- Insert data disc in drive one and hit return</td><td>&lt;CR&gt;</td></tr>
<tr><td>Pause -- Hit return and name the input file</td><td>&lt;CR&gt;
*DK:TTEST2.DAT
&lt;CR&gt;</td></tr>
<tr><td>Enter subject number</td><td>20935
&lt;CR&gt;</td></tr>
<tr><td>Enter check value to be analyzed: airspeed - enter 90.00; altitude - enter 2000.00; heading - enter 90.00;rate of climb - enter 0.00</td><td>2000.00
&lt;CR&gt;</td></tr>
</table>

Table 6

PHAN 3.FOR (Concluded)

Return Cell Values for Flight Data

Computer Output	User Input
NTER ERMEAN, ERRDEV, RTMEAN, RTDEV[1]	-340.56, 84.43, 0., 8.22 ⟨CR⟩
For the variable to be analyzed: airspeed - enter 21; altitude - enter 19; heading - enter 22; rate of climb - enter 23	19 ⟨CR⟩
For output 6 = LP[2] 7= T[3]	6 ⟨CR⟩
Enter start and stop position in file, enter ERMEAN	1, 9, -340.56 ⟨CR⟩
	62, 73, 109.25 ⟨CR⟩

[1] NTER ERMEAN = Enter error mean
ERRDEV = Error Deviation
RTMEAN = Mean Error Rate
RTDEV = Deviation of Error Rate

[2] LP = Line Printer

[3] TT = Teletype

Note: To end enter a negative number for the start position. You may enter more than one set of START, STOP, ERMEANS at a time. Remember to ⟨CR⟩ between

Example Output PHAN 3

```
SUBJECT:  20935
VARIABLE: 19
NUMBER OF SAMPLES:     9
VARIABLE SCALE:    1.00000
START POSITION:     1
STOP POSITION:     9
MEAN OF ERROR =       -340.5600
ERROR DEVIATION =          84.4300
MEAN OF ERROR RATE =           0.0000
DEVIATION OF ERROR RATE =          8.2200


   CELL VALUES

  -----+-----+-----+-----+-----
    1     2     3     4     5
  -----+-----+-----+-----+-----  +1.5
    6     7     8     9    10
  -----+-----+-----+-----+-----  +.5
   11    12    13    14    15    RATE OF ERROR
  -----+-----+-----+-----+-----  -.5
   16    17    18    19    20
  -----+-----+-----+-----+-----  -1.5
   21    22    23    24    25
  -----+-----+-----+-----+-----
      -1.5  -.5   +.5   +1.5
              ERROR


 INDEX    ERROR  RATE OF ERROR  CELL


    1  -133.440       35.000     5
    2   -98.440       38.000     5
    3   -60.440       38.000     5
    4   -22.440       34.000     5
    5    11.560       30.000     5
    6    41.560       26.000     5
    7    67.560       22.000     5
    8    89.560       15.000     5
 SUBJECT:  20935
 VARIABLE: 19
 NUMBER OF SAMPLES:    12
 VARIABLE SCALE:    1.00000
 START POSITION:    62
 STOP POSITION:    73
 MEAN OF ERROR =        109.2500
 ERROR DEVIATION =        84.4300
 MEAN OF ERROR RATE =         0.0000
 DEVIATION OF ERROR RATE =         8.2200
```

Example Output PHAN 3 (Continued)

```
CELL VALUES

-------+-------+-------+-------+-------
   1       2       3       4       5
-------+-------+-------+-------+-------  +1.5
   6       7       8       9      10
-------+-------+-------+-------+-------  +.5
  11      12      13      14      15     RATE OF ERROR
-------+-------+-------+-------+-------  -.5
  16      17      18      19      20
-------+-------+-------+-------+-------  -1.5
  21      22      23      24      25
-------+-------+-------+-------+-------

     -1.5    -.5     +.5    +1.5
             ERROR


INDEX     ERROR  RATE OF ERROR  CELL


     1  -39.250         12.000    6
     2  -27.250         14.000    1
     3  -13.250         16.000    2
     4    2.750          9.000    7
     5   11.750          0.000   12
     6   11.750         -4.000   12
     7    7.750         -4.000   12
     8    3.750         -2.000   12
     9    1.750          3.000   12
    10    4.750,         9.000    7
    11   13.750          8.000    7
SUBJECT:  20935
VARIABLE: 19
NUMBER OF SAMPLES:    28
VARIABLE SCALE:    1.00000
START POSITION:    81
STOP POSITION:   108
MEAN OF ERROR =          37.8900
ERROR DEVIATION =           84.4300
MEAN OF ERROR RATE =           0.0000
DEVIATION OF ERROR RATE =          8.2200


 CELL VALUES

-------+-------+-------+-------+-------
   1       2       3       4       5
-------+-------+-------+-------+-------  +1.5
   6       7       8       9      10
-------+-------+-------+-------+-------  +.5
  11      12      13      14      15     RATE OF ERROR
-------+-------+-------+-------+-------  -.5
  16      17      18      19      20
-------+-------+-------+-------+-------  -1.5
  21      22      23      24      25
-------+-------+-------+-------+-------

     -1.5    -.5     +.5    +1.5
             ERROR
```

Example Output PHAN 3 (Continued)

```
INDEX    ERROR  RATE OF ERROR  CELL

    1  145.110        -8.000    19
    2  137.110        -8.000    19
    3  129.110        -4.000    14
    4  125.110        -9.000    19
    5  116.110       -10.000    19
    6  106.110        -5.000    19
    7  101.110        -3.000    14
    8   98.110        -9.000    19
    9   89.110       -22.000    24
   10   67.110       -24.000    23
   11   43.110       -24.000    23
   12   19.110       -22.000    23
   13   -2.890       -21.000    23
   14  -23.890       -21.000    22
   15  -44.890       -16.000    22
   16  -60.890       -11.000    17
   17  -71.890       -12.000    17
   18  -83.890       -15.000    22
   19  -98.890       -14.000    21
   20 -112.890        -8.000    16
   21 -120.890         3.000    11
   22 -117.890         8.000     6
   23 -109.890        11.000     6
   24  -98.890        13.000     1
   25  -85.890        18.000     2
   26  -67.890        21.000     2
   27  -46.890        19.000     2
SUBJECT:  20035'
VARIABLE: 19
NUMBER OF SAMPLES:    12
VARIABLE SCALE:    1.00000
START POSITION:   112
STOP POSITION:   123
MEAN OF ERROR =          86.4200
ERROR DEVIATION =           84.4300
MEAN OF ERROR RATE =           0.0000
DEVIATION OF ERROR RATE =         8.2200


   CELL VALUES

----+-----+-----+-----+-----
  1     2     3     4     5
----+-----+-----+-----+------ +1.5
  6     7     8     9    10
----+-----+-----+-----+------ +.5
 11    12    13    14    15     RATE OF ERROR
----+-----+-----+-----+------ -.5
 16    17    18    19    20
----+-----+-----+-----+------ -1.5
 21    22    23    24    25
----+-----+-----+-----+-----
   -1.5   -.5   +.5   +1.5
             ERROR
```

Example Output PHAN 3 (Continued)

```
+X     ERROR   RATE OF ERROR   CELL

 1   -27.420            7.000     7
 2   -20.420            5.000     7
 3   -15.420            4.000    12
 4   -11.420            4.000    12
 5    -7.420            3.000    12
 6    -4.420            5.000     7
 7     0.500            7.000     7
 8     7.500            9.000     7
 9    16.500            3.000    12
10    19.500            1.000    12
11    20.500            1.000    12
```

```
CELL VALUES

----+-----+-----+-----+-----
    7     4     0     0     0
----+-----+-----+-----+-----  +1.5
    3     0     0     0     0
----+-----+-----+-----+-----  +.5
    1    11     0     2     0   RATE OF ERROR
----+-----+-----+-----+-----  -.5
    1     2     0     6     0
----+-----+-----+-----+-----  -1.5
    1     3     4     1     0
----+-----+-----+-----+-----
  -1.5   -.5   +.5  +1.5
          ERROR
```

Example Output PHAN 3 (Concluded)

```
CELL TRANSITION MATRIX:
   0  2  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
   0  2  0  0  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
   0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
   0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
   0  0  0  0  7  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
   2  0  0  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
   0  0  0  0  0  0  4  0  0  0  0  3  0  0  0  0  0  0  0  0  0  0  0  0  0
   0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
   0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
   0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
   0  0  0  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
   0  0  0  0  0  0  2  0  0  0  0  8  0  0  0  0  0  0  0  0  0  0  0  0  0
   0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
   0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  2  0  0  0  0  0  0
   0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
   0  0  0  0  0  0  0  0  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0
   0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0  1  0  0  0
   0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
   0  0  0  0  0  0  0  0  0  0  0  0  0  2  0  0  0  0  3  0  0  0  0  1  0
   0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
   0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0  0  0  0  0  0
   0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0  1  1  0  0  0
   0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  3  0  0
   0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0
   0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0

   0.00 1.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
   0.00 0.67 0.00 0.00 0.00 0.00 0.33 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
   0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
   0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
   0.00 0.00 0.00 0.00 1.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
   0.67 0.00 0.00 0.00 0.00 0.33 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
   0.00 0.00 0.00 0.00 0.00 0.00 0.57 0.00 0.00 0.00 0.00 0.43 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
   0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
   0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
   0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
   0.00 0.00 0.00 0.00 0.00 1.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
   0.00 0.00 0.00 0.00 0.00 0.00 0.20 0.00 0.00 0.00 0.00 0.80 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
   0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
   0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 1.00 0.00 0.00 0.00 0.00 0.00 0.00
   0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
   0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 1.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
   0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.50 0.00 0.00 0.00 0.00 0.50 0.00 0.00 0.00
   0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
   0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.33 0.00 0.00 0.00 0.00 0.50 0.00 0.00 0.00 0.00 0.17 0.00
   0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
   0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 1.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
   0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.33 0.00 0.00 0.00 0.33 0.33 0.00 0.00 0.00
   0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.25 0.75 0.00 0.00
   0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 1.00 0.00 0.00
   0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
```

Program Listing PHAN 4

```
FORTRAN IV      V01A-1    TUE 28-JUL-81 00:15:30            PAGE 001

      C     PHAN4.FOR
      C
      C     PURPOSE TO READ MULTIPLE COUNT MATRICES AND
      C     TO FORM ONE TRANSITION MATRIX
            DIMENSION KTMATX(25,25),ITMATX(25,25),ATMATX(25,25)
            DO 5 I=1,25
            DO 6 J=1,25
            KTMATX(I,J)=0
      6     CONTINUE
      5     CONTINUE
            PAUSE'HIT RETURN & NAME OUTPUT FILE'
            CALL ASSIGN(1,' ',-1,'NEW','NC',1)
      11    PAUSE'HIT RETURN & NAME INPUT FILE'
            CALL ASSIGN(2,' ',-1,'RDO','NC',1)
            DO 10 I=1,25
      10    READ(2,100)(ITMATX(I,J),J=1,25)
            DO 12 I=1,25
            DO 13 J=1,25
            KTMATX(I,J)=KTMATX(I,J)+ITMATX(I,J)
      13    CONTINUE
      12    CONTINUE
      C     COMPUTE TRANSITION MATRIX
            DO 14 I=1,25
            SUM=0.
            DO 15 J=1,25
            ATMATX(I,J)=FLOAT(KTMATX(I,J))
      15    SUM=SUM+ATMATX(I,J)
            DO 16 J=1,25
            IF(SUM.EQ.0.) SUM=1.
      16    ATMATX(I,J)=ATMATX(I,J)/SUM
      14    CONTINUE
            PAUSE'HIT RETURN &INPUT 1FOR CONTINUE,0 FOR STOP'
            READ(5,101)IANS
            CALL CLOSE(2)
            IF(IANS.EQ.1) GO TO 11
            DO 17 I=1,25
      17    WRITE(1,120)(ATMATX(I,J),J=1,25)
            CALL CLOSE(1)
            STOP
      100   FORMAT(25I4)
      101   FORMAT(I1)
      120   FORMAT(25F5.2)
            END
```

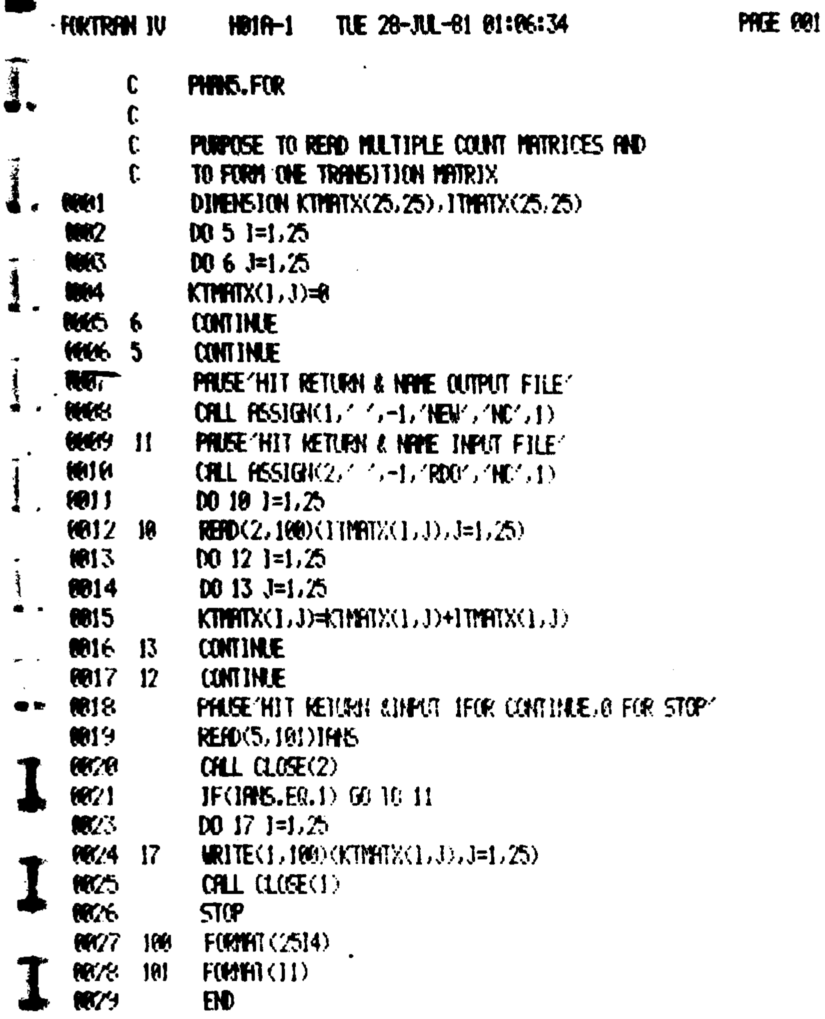
Table 7

PHAN 4.FOR

Purpose: Reads multiple count matrices and forms one transition matrix

Computer Output	User Input
	● Run PHAN 4 ⟨CR⟩
Pause - Hit RETURN and name Output File	⟨CR⟩ *DK:H491T3.DAT ⟨CR⟩
Pause - Hit RETURN and name Input File	⟨CR⟩ *DK:H491C3.DAT ⟨CR⟩
Pause - Hit RETURN and Input 1 for Continue, 0 for Stop	⟨CR⟩ * 1 ⟨CR⟩
Pause - Hit RETURN and name Input File	⟨CR⟩ *DK:H201C3.DAT ⟨CR⟩
Pause - Hit RETURN and Input 1 for Continue, 0 for Stop	⟨CR⟩ * 0 ⟨CR⟩

Program Listing PHAN 5



```
FORTRAN IV      V01A-1    TUE 28-JUL-81 01:06:34              PAGE 001

      C     PHAN5.FOR
      C
      C     PURPOSE TO READ MULTIPLE COUNT MATRICES AND
      C     TO FORM ONE TRANSITION MATRIX
            DIMENSION KTMATX(25,25),ITMATX(25,25)
            DO 5 I=1,25
            DO 6 J=1,25
            KTMATX(I,J)=0
        6   CONTINUE
        5   CONTINUE
            PAUSE'HIT RETURN & NAME OUTPUT FILE'
            CALL ASSIGN(1,' ',-1,'NEW','NC',1)
       11   PAUSE'HIT RETURN & NAME INPUT FILE'
            CALL ASSIGN(2,' ',-1,'RDO','NC',1)
            DO 10 I=1,25
       10   READ(2,100)(ITMATX(I,J),J=1,25)
            DO 12 I=1,25
            DO 13 J=1,25
            KTMATX(I,J)=KTMATX(I,J)+ITMATX(I,J)
       13   CONTINUE
       12   CONTINUE
            PAUSE'HIT RETURN &INPUT 1FOR CONTINUE,0 FOR STOP'
            READ(5,101)IANS
            CALL CLOSE(2)
            IF(IANS.EQ.1) GO TO 11
            DO 17 I=1,25
       17   WRITE(1,100)(KTMATX(I,J),J=1,25)
            CALL CLOSE(1)
            STOP
      100   FORMAT(25I4)
      101   FORMAT(I1)
            END
```

Table 8

PHAN 5.FOR

Purpose: Takes multiple count files and creates a single count file

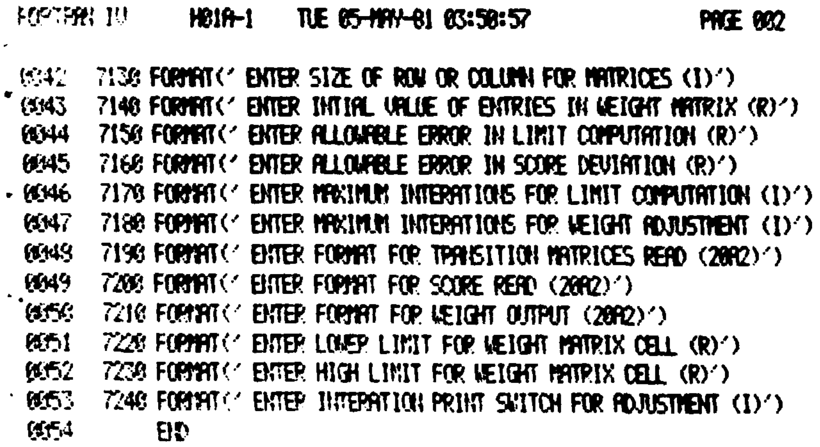
Computer Output	User Input
	● Run PHAN 5 ⟨CR⟩
Pause - Hit RETURN and name Output File	⟨CR⟩ *DK:HPC5.DAT ⟨CR⟩
Pause - Hit RETURN and name Input File	⟨CR⟩ *DK:H991C3.DAT ⟨CR⟩
Pause - Hit RETURN and Input 1 for Continue, 0 for Stop	⟨CR⟩ * 1 ⟨CR⟩
Pause - Hit RETURN and name Input File	⟨CR⟩ *DK:H201C3.DAT ⟨CR⟩
Pause - Hit RETURN and Input 1 for Continue, 0 for Stop	⟨CR⟩ * 0 ⟨CR⟩

Program Listing WTMAT

```
FORTRAN IV      H01A-1    TUE 28-JUL-81 08:09:51                 PAGE 001

        C PROGRAM 'WTMAT.FOR'
        C CREATED FOR THE H11A SYSTEM
        C ORIGINAL DATE: 4-JAN-80
        C PURPOSE: STOCHASTIC ADJUSTMENT FOR THE 'MAP' SYSTEM
        C TRANSITION MATRICES AND THE SCORE ASSOCIATED WITH
        C EACH MATRIX ARE THE INPUT VARIABLES.
        C OUTPUT IS A WEIGHT MATRIX WHICH MAY BE USED TO SCORE
        C THE PERFORMANCE OF A SAMPLE.
0001          COMMON /RBLOCK/ TRANS,TSPROB,DLIMIT,
             1                DLHOLD,WEIGHT,
             2                PSCORE,CSCORE,GAIN,
             3                ADJINT,ERRADJ,ERRLIM,
             4                WLOW,WHIGH
0002          COMMON /IBLOCK/ IFRMT1,IFRMT2,IFRMT3,
             1                IOLFND,NUMMAT,ITMSIZ,
             2                MAXDL1,MAXAIT,IADONE,
             3                MAINT,ISOTH,LENGTH
             4                IBIG1,IBIG2,IBIG3,IPSUT1
0003          DIMENSION TRANS(2000),TSPROB(2000),
             1          DLIMIT(625),DLHOLD(625),
             2          WEIGHT(625),
             3          PSCORE(25),CSCORE(25),GAIN(25),IOLFND(25),
             4          IFRMT1(25),IFRMT2(25),IFRMT3(25)
0004          PAUSE 'INSERT DATA DISC IN UNIT ONE (DX1) AND HIT RETURN'
        C READ CONTROL VARIABLES
0005          CALL CUREAD
        C INTIALIZE WORK VARIABLES
0006          CALL INTIAL
        C READ THE PROBLEM VARIABLES
0007          CALL PUREAD
        C COMPUTE THE LIMITING DISTRIBUTIONS FOR
        C THE TRANSITION MATRICES
0008          CALL TMDLIM
        C COMPUTE THE TRANSTATE PROBABLITY MATRICES
0009          CALL TSPM
        C COMPUTE THE GAIN FACTOR FOR EACH MATRIX
0010          CALL TMGAIN
        C PERFORM THE STOCHASTIC ADJUSTMENT PROCEDURE
0011          CALL ADJUST
        C OUTPUT THE RESULTS
0012          CALL PWRITE
0013          STOP 'END OF PROGRAM STCADJ.FOR'
0014          END
```

Subroutine CVREAD

```
FORTRAN IV      V01A-1    TUE 05-MAY-81 03:50:57              PAGE 001

              SUBROUTINE CVREAD
C PURPOSE IS TO READ THE CONTROL VARIABLES
              COMMON /RBLOCK/ TRANS,TSPROB,DLIMIT,
     1                        DLHOLD,WEIGHT,
     2                        PSCORE,CSCORE,GAIN,
     3                        ADJINT,ERRADJ,ERRLIM,
     4                        WLOW,WHIGH
              COMMON /IBLOCK/ IFRMT1,IFRMT2,IFRMT3,
     1                        IDLFND,NUMMAT,ITMSIZ,
     2                        MAXDLI,MAXAIT,IADONE,
     3                        MAINT,ISQTM,LENGTH,
     4                        IBIG1,IBIG2,IBIG3,IPSWT1
              DIMENSION TRANS(2000),TSPROB(2000),
     1              DLIMIT(400),DLHOLD(400),
     2              WEIGHT(400),
     3              PSCORE(20),CSCORE(20),GAIN(20),IDLFND(20),
     4              IFRMT1(20),IFRMT2(20),IFRMT3(20)
              WRITE(7,7100)
              CALL ASSIGN(1,' ',-1,'RDO','NC',1)
              WRITE(7,7110)
              CALL ASSIGN(2,' ',-1,'NEW','NC',1)
              WRITE(7,7120)
              READ(5,5100) NUMMAT
              WRITE(7,7130)
              READ(5,5100) ITMSIZ
              WRITE(7,7140)
              READ(5,5200) ADJINT
              WRITE(7,7150)
              READ(5,5200) ERRLIM
              WRITE(7,7160)
              READ(5,5200) ERRADJ
              WRITE(7,7170)
              READ(5,5100) MAXDLI
              WRITE(7,7180)
              READ(5,5100) MAXAIT
              WRITE(7,7190)
              READ(5,5300) (IFRMT1(I),I=1,20)
              WRITE(7,7200)
              READ(5,5300) (IFRMT2(I),I=1,20)
              WRITE(7,7210)
              READ(5,5300) (IFRMT3(I),I=1,20)
              WRITE(7,7220)
              READ(5,5200) WLOW
              WRITE(7,7230)
              READ(5,5200) WHIGH
              WRITE(7,7240)
              READ(5,5100) IPSWT1
              RETURN
         5100 FORMAT(I7)
         5200 FORMAT(F13.6)
         5300 FORMAT(20A2)
         7100 FORMAT(' NAME THE INPUT FILE'/)
         7110 FORMAT(' NAME THE RESULT FILE'/)
         7120 FORMAT(' ENTER THE NUMBER OF TRANSITION MATRICES (I)')
```

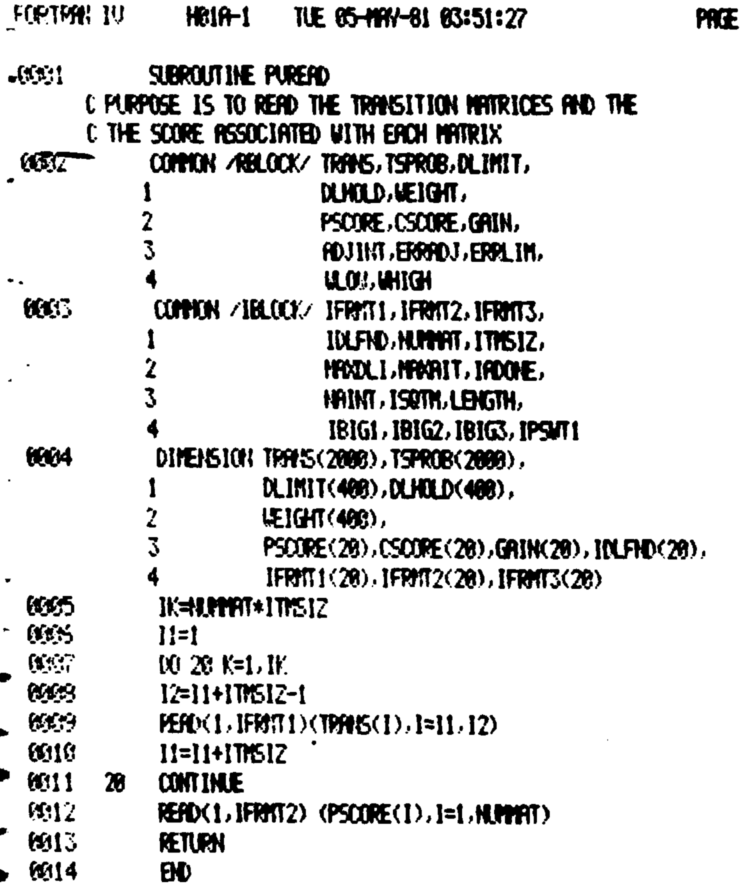


```
FORTRAN IV      H01A-1    TUE 05-MAY-81 03:50:57             PAGE 002

      7130 FORMAT(' ENTER SIZE OF ROW OR COLUMN FOR MATRICES (I)')
      7140 FORMAT(' ENTER INTIAL VALUE OF ENTRIES IN WEIGHT MATRIX (R)')
      7150 FORMAT(' ENTER ALLOWABLE ERROR IN LIMIT COMPUTATION (R)')
      7160 FORMAT(' ENTER ALLOWABLE ERROR IN SCORE DEVIATION (R)')
      7170 FORMAT(' ENTER MAXIMUM INTERATIONS FOR LIMIT COMPUTATION (I)')
      7180 FORMAT(' ENTER MAXIMUM INTERATIONS FOR WEIGHT ADJUSTMENT (I)')
      7190 FORMAT(' ENTER FORMAT FOR TRANSITION MATRICES READ (20A2)')
      7200 FORMAT(' ENTER FORMAT FOR SCORE READ (20A2)')
      7210 FORMAT(' ENTER FORMAT FOR WEIGHT OUTPUT (20A2)')
      7220 FORMAT(' ENTER LOWER LIMIT FOR WEIGHT MATRIX CELL (R)')
      7230 FORMAT(' ENTER HIGH LIMIT FOR WEIGHT MATRIX CELL (R)')
      7240 FORMAT(' ENTER INTERATION PRINT SWITCH FOR ADJUSTMENT (I)')
           END
```

Subroutine INTIAL

```
FORTRAN IV      HBIA-1    TUE 05-MAY-81 03:51:13               PAGE 001

0001       SUBROUTINE INTIAL
      C PURPOSE IS TO INTIALIZE VARIABLES IN COMMON
0002        COMMON /RBLOCK/ TRANS,TSPROB,DLIMIT,
          1                 DLHOLD,WEIGHT,
          2                 PSCORE,CSCORE,GAIN,
          3                 ADJINT,ERRADJ,ERRLIM,
          4                 WLOW,WHIGH
0003        COMMON /IBLOCK/ IFRMT1,IFRMT2,IFRMT3,
          1                 IDLFND,NUMMAT,ITMSIZ,
          2                 MAXDLI,MAXAIT,IADONE,
          3                 NAINT,ISQTM,LENGTH,
          4                 IBIG1,IBIG2,IBIG3,IPSWT1
0004        DIMENSION TRANS(2000),TSPROB(2000),
          1          DLIMIT(400),DLHOLD(400),
          2          WEIGHT(400),
          3          PSCORE(20),CSCORE(20),GAIN(20),IDLFND(20),
          4          IFRMT1(20),IFRMT2(20),IFRMT3(20)
0005        IBIG1=2000
0006        IBIG2=400
0007        IBIG3=20
0008        IADONE=0
0009        NAINT=0
0010        ISQTM=ITMSIZ*ITMSIZ
0011        LENGTH=NUMMAT*ITMSIZ*ITMSIZ
0012        DLINT=1.0/FLOAT(ITMSIZ)
0013        DO 100 I=1,IBIG1
0014        TRANS(I)=0.0
0015        TSPROB(I)=0.0
0016        IF(I.GT.IBIG2) GO TO 100
0018        WEIGHT(I)=ADJINT
0019        DLHOLD(I)=DLINT
0020        DLIMIT(I)=0.0
0021        IF(I.GT.IBIG3) GO TO 100
0023        PSCORE(I)=0.0
0024        CSCORE(I)=0.0
0025        GAIN(I)=0.0
0026        IDLFND(I)=0
0027    100 CONTINUE
0028        RETURN
0029        END
```

Subroutine PVREAD

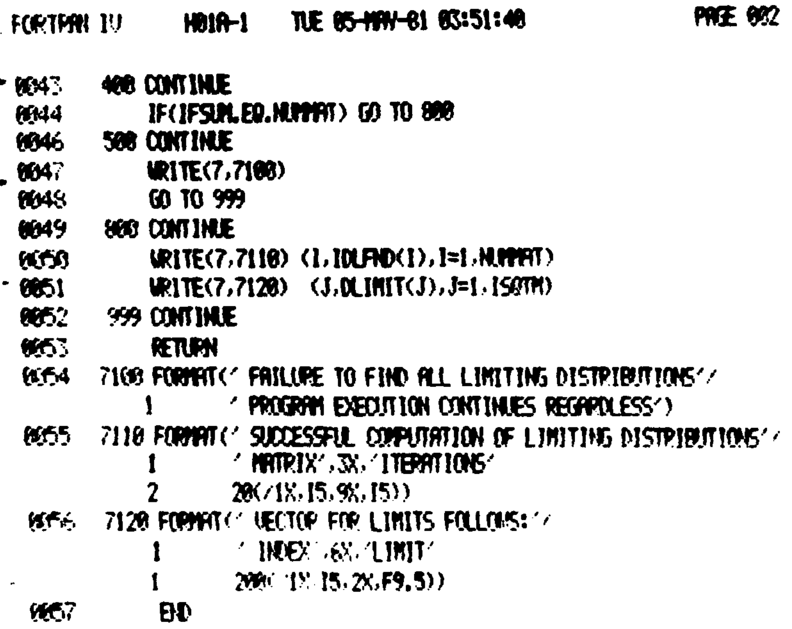


```
 FORTRAN IV      H01A-1    TUE 05-MAY-81 03:51:27              PAGE 001

 0001         SUBROUTINE PVREAD
        C PURPOSE IS TO READ THE TRANSITION MATRICES AND THE
        C THE SCORE ASSOCIATED WITH EACH MATRIX
 0002         COMMON /RBLOCK/ TRANS,TSPROB,DLIMIT,
             1                DLHOLD,WEIGHT,
             2                PSCORE,CSCORE,GAIN,
             3                ADJINT,ERRADJ,ERRLIM,
             4                WLOW,WHIGH
 0003         COMMON /IBLOCK/ IFRMT1,IFRMT2,IFRMT3,
             1                IDLFND,NUMMAT,ITMSIZ,
             2                MAXDLI,MAXAIT,IADONE,
             3                NAINT,ISQTM,LENGTH,
             4                IBIG1,IBIG2,IBIG3,IPSWT1
 0004         DIMENSION TRANS(2000),TSPROB(2000),
             1          DLIMIT(400),DLHOLD(400),
             2          WEIGHT(400),
             3          PSCORE(20),CSCORE(20),GAIN(20),IDLFND(20),
             4          IFRMT1(20),IFRMT2(20),IFRMT3(20)
 0005         IK=NUMMAT*ITMSIZ
 0006         I1=1
 0007         DO 20 K=1,IK
 0008         I2=I1+ITMSIZ-1
 0009         READ(1,IFRMT1)(TRANS(I),I=I1,I2)
 0010         I1=I1+ITMSIZ
 0011    20   CONTINUE
 0012         READ(1,IFRMT2) (PSCORE(I),I=1,NUMMAT)
 0013         RETURN
 0014         END
```

Subroutine TMDLIM

```
FORTRAN IV      V01A-1    TUE 05-MAY-81 03:51:40               PAGE 001

          SUBROUTINE TMDLIM
     C PURPOSE IS TO COMPUTE THE LIMITING DISTRIBUTION
     C FOR EACH OF THE TRANSITION MATRICES
          COMMON /RBLOCK/ TRANS,TSPROB,DLIMIT,
         1                DLHOLD,WEIGHT,
         2                PSCORE,CSCORE,GAIN,
         3                ADJINT,ERRADJ,ERRLIM,
         4                WLOW,WHIGH
          COMMON /IBLOCK/ IFRMT1,IFRMT2,IFRMT3,
         1                IDLFND,NUMMAT,ITMSIZ,
         2                MAXDLI,MAXAIT,IADONE,
         3                NAINT,ISOTM,LENGTH,
         4                IBIG1,IBIG2,IBIG3,IPSWT1
          DIMENSION TRANS(2000),TSPROB(2000),
         1          DLIMIT(400),DLHOLD(400),
         2          WEIGHT(400),
         3          PSCORE(20),CSCORE(20),GAIN(20),IDLFND(20),
         4          IFRMT1(20),IFRMT2(20),IFRMT3(20),
         5          TMHOLD(2000)
          DO 500 I=1,MAXDLI
          DO 300 J=1,NUMMAT
          IF(IDLFND(J).NE.0) GO TO 300
          KSTART=(J-1)*ITMSIZ+1
          KSTOP=KSTART+ITMSIZ-1
          SSQERR=0.0
          DO 200 K=KSTART,KSTOP
          LSTART=(K-1)*ITMSIZ+1
          LSTOP=LSTART+ITMSIZ-1
          DO 100 L=LSTART,LSTOP
          TMHOLD(L)=DLHOLD(K)*TRANS(L)
          WRITE(7,12) TMHOLD(L),DLHOLD(K),TRANS(L)
     12   FORMAT(3F10.3)
      100 CONTINUE
      200 CONTINUE
          KDUM=0
          DO 220 K=KSTART,KSTOP
          KDUM=KDUM+1
          LSTART=(J-1)*ISOTM+KDUM
          LSTOP=LSTART+ISOTM-1
          DLIMIT(K)=0.0
          DO 210 L=LSTART,LSTOP,ITMSIZ
          DLIMIT(K)=DLIMIT(K)+TMHOLD(L)
          WRITE(7,13)DLIMIT(K)
     13   FORMAT(F12.4)
      210 CONTINUE
          ERROR=DLIMIT(K)-DLHOLD(K)
          SSQERR=SSQERR+ERROR*ERROR
          DLHOLD(K)=DLIMIT(K)
      220 CONTINUE
          IF(SSQERR.LE.ERRLIM) IDLFND(J)=I
      300 CONTINUE
          IFSUM=0
          DO 400 M=1,NUMMAT
          IF(IDLFND(M).NE.0) IFSUM=IFSUM+1
```

Subroutine TMDLIM (Concluded)

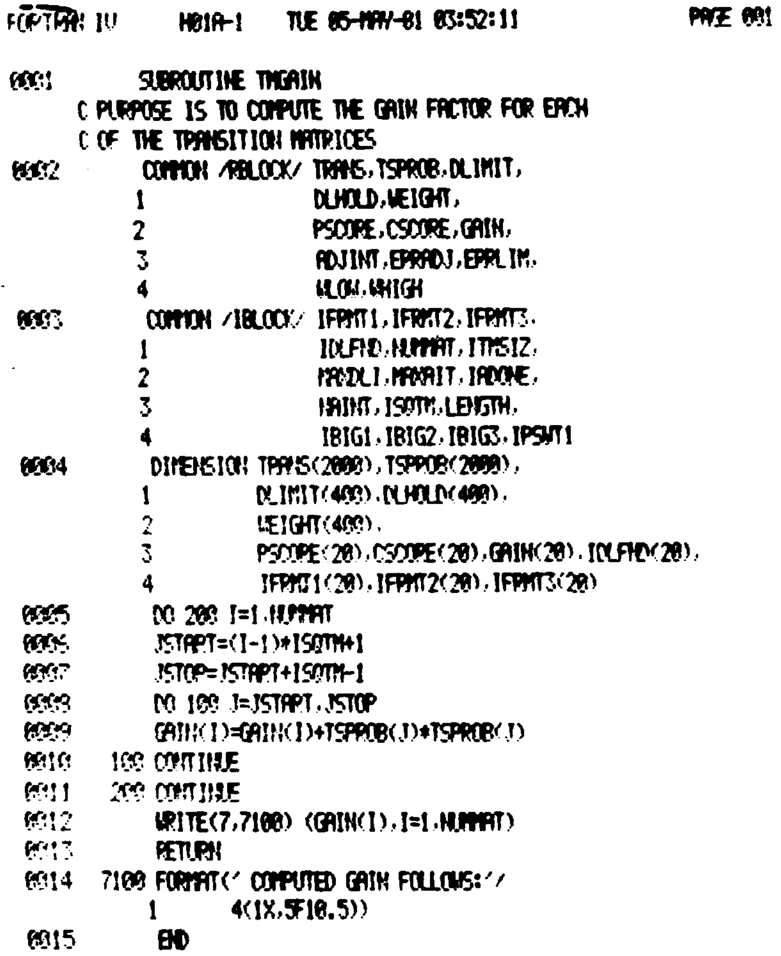


```
FORTRAN IV      H01A-1    TUE 05-MAY-81 03:51:40              PAGE 002

0043    400 CONTINUE
0044        IF(IFSUM.EQ.NUMMAT) GO TO 800
0046    500 CONTINUE
0047        WRITE(7,7100)
0048        GO TO 999
0049    800 CONTINUE
0050        WRITE(7,7110) (I,IDLFND(I),I=1,NUMMAT)
0051        WRITE(7,7120)  (J,DLIMIT(J),J=1,ISQTM)
0052    999 CONTINUE
0053        RETURN
0054   7100 FORMAT(' FAILURE TO FIND ALL LIMITING DISTRIBUTIONS'/
           1       ' PROGRAM EXECUTION CONTINUES REGARDLESS')
0055   7110 FORMAT(' SUCCESSFUL COMPUTATION OF LIMITING DISTRIBUTIONS'/
           1       ' MATRIX',3X,'ITERATIONS'
           2       20(/1X,I5,9X,I5))
0056   7120 FORMAT(' VECTOR FOR LIMITS FOLLOWS:'/
           1        ' INDEX',6X,'LIMIT'
           1       200(/1X,I5,2X,F9.5))
0057        END
```

Subroutine TSPM

```
FORTRAN IV      V01A-1    TUE 05-MAY-81 03:51:57              PAGE 001

            SUBROUTINE TSPM
      C PURPOSE IS TO COMPUTE THE TRANSTATE PROBABLITY MATRICES
            COMMON /RBLOCK/ TRANS,TSPROB,DLIMIT,
          1                 DLHOLD,WEIGHT,
          2                 PSCOPE,CSCORE,GAIN,
          3                 ADJINT,ERRADJ,ERRLIM,
          4                 WLOW,WHIGH
            COMMON /IBLOCK/ IFRMT1,IFRMT2,IFRMT3,
          1                 IDLFND,NUMMAT,ITMSIZ,
          2                 MAXDL1,MAXAIT,IADONE,
          3                 NAINT,ISOTM,LENGTH,
          4                 IBIG1,IBIG2,IBIG3,IPSWT1
            DIMENSION TRANS(2000),TSPROB(2000),
          1          DLIMIT(400),DLHOLD(400),
          2          WEIGHT(400),
          3          PSCOPE(20),CSCOPE(20),GAIN(20),IDLFND(20),
          4          IFRMT1(20),IFRMT2(20),IFRMT3(20),
          5          STPPRB(20)
            DO 300 I=1,NUMMAT
            STPPRB(I)=0.0
            JSTART=(I-1)*ITMSIZ+1
            JSTOP=JSTART+ITMSIZ-1
            DO 200 J=JSTART,JSTOP
            KSTART=(J-1)*ITMSIZ+1
            KSTOP=KSTART+ITMSIZ-1
            DO 100 K=KSTART,KSTOP
            TSPROB(K)=DLIMIT(J)*TRANS(K)
            STPPRB(I)=STPPRB(I)+TSPROB(K)
        100 CONTINUE
        200 CONTINUE
        300 CONTINUE
            WRITE(7,7100) (STPPRB(I),I=1,NUMMAT)
            WRITE(7,7110) (I,TSPROB(I),I=1,LENGTH)
            RETURN
       7100 FORMAT(' CHECK SUM FOR TRANSTATE MATRICES'/
          1        ' SHOULD BE EQUAL TO 1.0 (APPROXIMATELY)'/
          2        4(1X,5F10.5/))
       7110 FORMAT(' TRANSTATE VECTOR FOLLOWS:'/
          1        ' INDEX',9X,'VALUE',
          2        200(/1X,I5,1X,F13.5))
            END
```

Subroutine TMGAIN

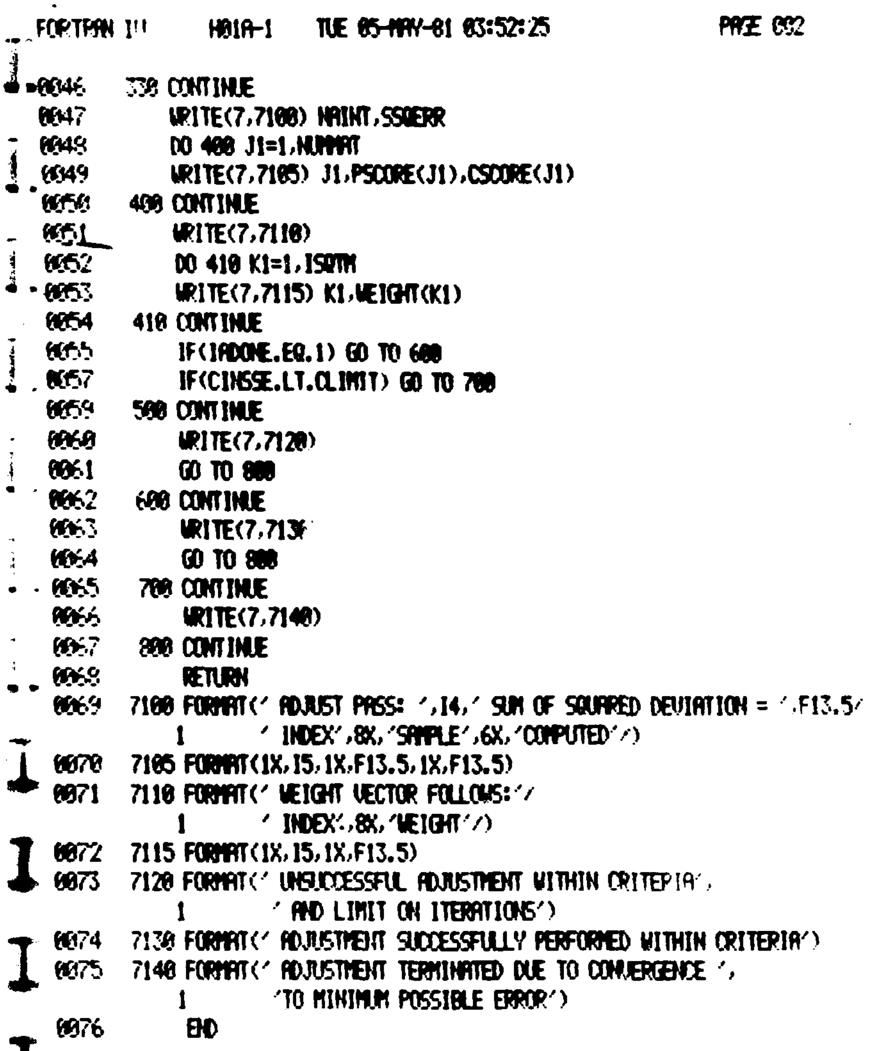


```
FORTRAN IV      H01A-1    TUE 05-MAY-81 03:52:11                PAGE 001

 0001           SUBROUTINE TMGAIN
          C PURPOSE IS TO COMPUTE THE GAIN FACTOR FOR EACH
          C OF THE TRANSITION MATRICES
 0002           COMMON /RBLOCK/ TRANS,TSPROB,DLIMIT,
               1                 DLHOLD,WEIGHT,
               2                 PSCORE,CSCORE,GAIN,
               3                 ADJINT,EPRADJ,EPRLIM,
               4                 WLOW,WHIGH
 0003           COMMON /IBLOCK/ IFRMT1,IFRMT2,IFRMT3,
               1                 IDLFND,NUMMAT,ITMSIZ,
               2                 MAXDLI,MAXRIT,IADONE,
               3                 NAINT,ISQTM,LENGTH,
               4                 IBIG1,IBIG2,IBIG3,IPSWT1
 0004           DIMENSION TRANS(2000),TSPROB(2000),
               1          DLIMIT(400),DLHOLD(400),
               2          WEIGHT(400),
               3          PSCORE(20),CSCORE(20),GAIN(20),IDLFND(20),
               4          IFRMT1(20),IFRMT2(20),IFRMT3(20)
 0005           DO 200 I=1,NUMMAT
 0006           JSTART=(I-1)*ISQTM+1
 0007           JSTOP=JSTART+ISQTM-1
 0008           DO 100 J=JSTART,JSTOP
 0009           GAIN(I)=GAIN(I)+TSPROB(J)*TSPROB(J)
 0010       100 CONTINUE
 0011       200 CONTINUE
 0012           WRITE(7,7100) (GAIN(I),I=1,NUMMAT)
 0013           RETURN
 0014      7100 FORMAT(' COMPUTED GAIN FOLLOWS:'/
               1       4(1X,5F10.5))
 0015           END
```

Subroutine ADJUST

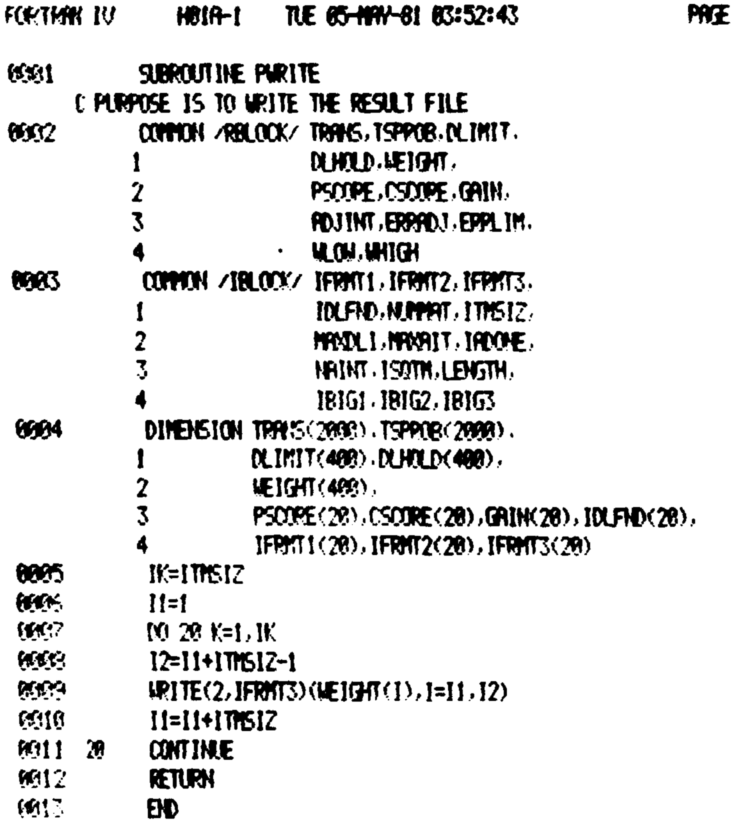
```
FORTRAN IV      V01A-1    TUE 05-MAY-81 03:52:25              PAGE 001

0001          SUBROUTINE ADJUST
        C PURPOSE IS TO PERFORM THE WEIGHT MATRIX ADJUSTMENT
        C PROCEDURE UNTIL CONVERGANCE OR MAXIMUM
        C INTERATIONS ARE PERFORMED
0002          COMMON /RBLOCK/ TRANS,TSPROB,DLIMIT,
             1                DLHOLD,WEIGHT,
             2                PSCORE,CSCORE,GAIN,
             3                ADJINT,ERRADJ,ERRLIM,
             4                WLOW,WHIGH
0003          COMMON /IBLOCK/ IFRMT1,IFRMT2,IFRMT3,
             1                IDLFND,NUMMAT,ITMSIZ,
             2                MAXDLI,MAXAIT,IADONE,
             3                NAINT,ISQTM,LENGTH,
             4                IBIG1,IBIG2,IBIG3,IPSWT1
0004          DIMENSION TRANS(2000),TSPROB(2000),
             1          DLIMIT(400),DLHOLD(400),
             2          WEIGHT(400),
             3          PSCORE(20),CSCORE(20),GAIN(20),IDLFND(20),
             4          IFRMT1(20),IFRMT2(20),IFRMT3(20)
0005          SSEHLD=0.1E+20
0006          CLIMIT=0.1
0007          DO 500 I=1,MAXAIT
0008          NAINT=NAINT+1
0009          DO 300 J=1,NUMMAT
0010          CSCORE(J)=0.0
0011          DO 100 K=1,ISQTM
0012          L=(J-1)*ISQTM+K
0013          CSCORE(J)=CSCORE(J)+WEIGHT(K)*TSPROB(L)
0014      100 CONTINUE
0015          ERROR=PSCORE(J)-CSCORE(J)
0016          AJGAIN=ERROR/GAIN(J)
0017          DO 200 M=1,ISQTM
0018          N=(J-1)*ISQTM+M
0019          WEIGHT(M)=WEIGHT(M)+AJGAIN*TSPROB(N)
0020          IF(WEIGHT(M).LT.WLOW) WEIGHT(M)=WLOW
0022          IF(WEIGHT(M).GT.WHIGH) WEIGHT(M)=WHIGH
0024      200 CONTINUE
0025      300 CONTINUE
0026          SSQERR=0.0
0027          DO 320 J=1,NUMMAT
0028          CSCORE(J)=0.0
0029          DO 310 K=1,ISQTM
0030          L=(J-1)*ISQTM+K
0031          CSCORE(J)=CSCORE(J)+WEIGHT(K)*TSPROB(L)
0032      310 CONTINUE
0033          ERROR=PSCORE(J)-CSCORE(J)
0034          SSQERR=SSQERR+ERROR*ERROR
0035      320 CONTINUE
0036          IF(SSQERR.LE.ERRADJ) IADONE=1
0038          IF(IADONE.EQ.1) GO TO 330
0040          CINSSE=ABS(SSEHLD-SSQERR)
0041          IF(CINSSE.LT.CLIMIT) GO TO 330
0043          SSEHLD=SSQERR
0044          IF(MOD(NAINT,IPSWT1).NE.0) GO TO 500
```

Subroutine ADJUST (Concluded)



```
FORTRAN IV      H01A-1    TUE 05-MAY-81 03:52:25              PAGE 002

      330 CONTINUE
          WRITE(7,7100) NAINT,SSQERR
          DO 400 J1=1,NUMMAT
          WRITE(7,7105) J1,PSCORE(J1),CSCORE(J1)
      400 CONTINUE
          WRITE(7,7110)
          DO 410 K1=1,ISQTM
          WRITE(7,7115) K1,WEIGHT(K1)
      410 CONTINUE
          IF(IADONE.EQ.1) GO TO 600
          IF(CINSSE.LT.CLIMIT) GO TO 700
      500 CONTINUE
          WRITE(7,7120)
          GO TO 800
      600 CONTINUE
          WRITE(7,713
          GO TO 800
      700 CONTINUE
          WRITE(7,7140)
      800 CONTINUE
          RETURN
     7100 FORMAT(' ADJUST PASS: ',I4,' SUM OF SQUARED DEVIATION = ',F13.5/
         1       ' INDEX',8X,'SAMPLE',6X,'COMPUTED'/)
     7105 FORMAT(1X,I5,1X,F13.5,1X,F13.5)
     7110 FORMAT(' WEIGHT VECTOR FOLLOWS:'/
         1       ' INDEX',8X,'WEIGHT'/)
     7115 FORMAT(1X,I5,1X,F13.5)
     7120 FORMAT(' UNSUCCESSFUL ADJUSTMENT WITHIN CRITERIA',
         1        ' AND LIMIT ON ITERATIONS')
     7130 FORMAT(' ADJUSTMENT SUCCESSFULLY PERFORMED WITHIN CRITERIA')
     7140 FORMAT(' ADJUSTMENT TERMINATED DUE TO CONVERGENCE ',
         1        'TO MINIMUM POSSIBLE ERROR')
          END
```

Subroutine PWRITE



```
FORTRAN IV      HBIA-I    TUE 05-MAY-81 03:52:43              PAGE 001

0001          SUBROUTINE PWRITE
        C PURPOSE IS TO WRITE THE RESULT FILE
0002          COMMON /RBLOCK/ TRANS,TSPPOB,DLIMIT,
             1                DLHOLD,WEIGHT,
             2                PSCORE,CSCORE,GAIN,
             3                ADJINT,ERRADJ,EPPLIM,
             4                WLOW,WHIGH
0003          COMMON /IBLOCK/ IFRMT1,IFRMT2,IFRMT3,
             1                IDLFND,NUMMAT,ITMSIZ,
             2                MAXDL1,MAXAIT,IADONE,
             3                NAINT,ISOTM,LENGTH,
             4                IBIG1,IBIG2,IBIG3
0004          DIMENSION TRANS(2000),TSPPOB(2000),
             1          DLIMIT(400),DLHOLD(400),
             2          WEIGHT(400),
             3          PSCORE(20),CSCORE(20),GAIN(20),IDLFND(20),
             4          IFRMT1(20),IFRMT2(20),IFRMT3(20)
0005          IK=ITMSIZ
0006          I1=1
0007          DO 20 K=1,IK
0008          I2=I1+ITMSIZ-1
0009          WRITE(2,IFRMT3)(WEIGHT(I),I=I1,I2)
0010          I1=I1+ITMSIZ
0011    20    CONTINUE
0012          RETURN
0013          END
```

Table 9

WTMAT. FOR

Stochastic Adjustment for the "Map" System

Purpose: The computer takes the transition matrix and provides a score matrix.

Computer Output	User Input
	● Run WTMAT ⟨CR⟩
Pause -- Insert data disc in unit one (DK:) and hit return	⟨CR⟩
Name the input file	*DK:TTEST1.DAT ⟨CR⟩
Name the result file	*DK:TTEST2.DAT ⟨CR⟩
Enter the number of transition matrices (I)[1]	2 ⟨CR⟩
Enter size of row or column for matrices (I)	5 ⟨CR⟩

[1] I = integer

Table 9

WTMAT . FOR (Continued)

Stochastic Adjustment for the "Map" System	
Computer Output	User Input
Enter initial value of entries in weight matrix (R)[2]	50. ⟨CR⟩
Enter allowable error in limit computation (R)	.001 ⟨CR⟩
Enter allowable error in score deviation (R)	5. ⟨CR⟩
Enter maximum interations for limit computation (I)	200 ⟨CR⟩
Enter maximum interations for weight adjustment (I)	200 ⟨CR⟩
Enter format for transition matrices read (20A2)	(5F3.1)[3] ⟨CR⟩

[2] R = real number. You must use a decimal point whenever the (R) appears.

[3] Whenever formats are indicated, parenthesis must be used.

Table 9

WTMAT. FOR (Concluded)

Stochastic Adjustment for the "Map" System	
Computer Output	User Input
Enter format for score read (20A2)	(2F5.1) ⟨CR⟩
Enter format for weight output (20A2)	(5F5.0) ⟨CR⟩
Enter lower limit for weight matrix cell (R)	0. ⟨CR⟩
Enter high limit for weight matrix cell (R)	99. ⟨CR⟩
Enter interation print switch for adjustment (I)	1 ⟨CR⟩

Example Output WTMAT

WTMAT

Score Matrix

1	99.	99.	21.	99.
99.	50.	22.	99.	33.
70.	87.	67.	50.	50.
50.	99.	24.	99.	18.
9.9.	99.	61.	99.	99.

Program Listing MLREG1

```
FORTRAN IV      V01A-1    FRI 01-MAY-81 02:20:08              PAGE 001

      C PROGRAM 'MLREG1.FOR'
      C PURPOSE IS TO PERFORM A MULTIPLE LINEAR
      C REGRESSION ANALYSIS UTILIZING
      C SUBROUTINES FROM THE IBM SS PACKAGE
            DIMENSION X(6000),XBAR(20),STD(20),SCP(400),
           1          R(210),DSCP(20),RX(361),RY(19),IFORMT(20),
           2          RCOEF(19),SDRC(19),TVAL(19),ANS(10),
           3          WORK1(20),WORK2(20),ISAVE(20),IWORK1(19),IWORK2(19)
            DATA X/6000*0.0/,XBAR/20*0.0/,STD/20*0.0/,
           1    SCP/400*0.0/,IFORMT/20*'  '/,R/210*0.0/,DSCP/20*0.0/,
           2    RX/361*0.0/,RY/19*0.0/,RCOEF/19*0.0/,
           3    SDRC/19*0.0/,TVAL/19*0.0/,ANS/10*0.0/,
           4    WORK1/20*0.0/,WORK2/20*0.0/,ISAVE/20*0/,
           5    IREAD/0/,IWORK1/19*0/,IWORK2/19*0
            PAUSE 'INSERT DATA DISC IN UNIT ONE (DK1) AND HIT RETURN'
            WRITE(7,7110)
            CALL ASSIGN(2,' ',-1,'RDO','NC',4)
            WRITE(7,7115)
            READ(5,5110) NOBS
            WRITE(7,7120)
            READ(5,5110) NVAR
            WRITE(7,7130)
            READ(5,5110) NIVAR
            WRITE(7,7140)
            READ(5,5120) (ISAVE(I),I=1,NIVAR)
            WRITE(7,7150)
            READ(5,5110) IDEPNT
            WRITE(7,7160)
            READ(5,5110) IUNIT
            WRITE(7,7170)
            READ(5,5130) (IFORMT(I),I=1,20)
            ISTOP=NOBS*(NVAR-1)+1
            DO 100 J=1,NOBS
            READ(2,IFORMT) (X(I),I=J,ISTOP,NOBS)
            IREAD=IREAD+1
            ISTOP=ISTOP+1
        100 CONTINUE
            CALL CORR(NOBS,NVAR,X,XBAR,STD,SCP,R,DSCP,WORK1,WORK2)
            CALL ORDER(NVAR,R,IDEPNT,NIVAR,ISAVE,RX,RY)
            CALL MINV(RX,NIVAR,DETRMT,IWORK1,IWORK2)
            CALL MULTR(NOBS,NIVAR,XBAR,STD,DSCP,RX,RY,ISAVE,
           1          RCOEF,SDRC,TVAL,ANS)
            CALL ORDER(NVAR,R,IDEPNT,NIVAR,ISAVE,RX,RY)
            CALL LWRITE(NOBS,NVAR,NIVAR,XBAR,STD,SCP,DSCP,RX,RY,ISAVE,RCOEF,
           1           SDRC,TVAL,ANS,IUNIT,IDEPNT)
            STOP 'END OF PROGRAM MLREG1.FOR'
       1000 FORMAT(32F8.3)
       5110 FORMAT(I7)
       5120 FORMAT(19I4)
       5130 FORMAT(20A2)
       7110 FORMAT(' NAME THE INPUT FILE (ASSIGN)')
       7115 FORMAT(' ENTER NUMBER OF OBSERVATIONS (I)')
       7120 FORMAT(' ENTER NUMBER OF VARIABLES (I)')
       7130 FORMAT(' ENTER NUMBER OF INDEPENDENT VARIABLES (I)')
```

Program Listing MLREG1 (Concluded)

```
FORTRAN IV      H01A-1    FRI 01-MAY-81 02:28:38               PAGE 002

      7140 FORMAT(' ENTER INDICIES OF INDEPENDENT VARIABLES (19I4)')
      7150 FORMAT(' ENTER INDEX OF DEPENDENT VARIABLE (I)')
      7160 FORMAT(' ENTER THE OUTPUT UNIT NUMBER (6=LP:,7=TT:)')
      7170 FORMAT(' ENTER THE INPUT FORMAT SPECIFICATION (20A2)')
           END
```

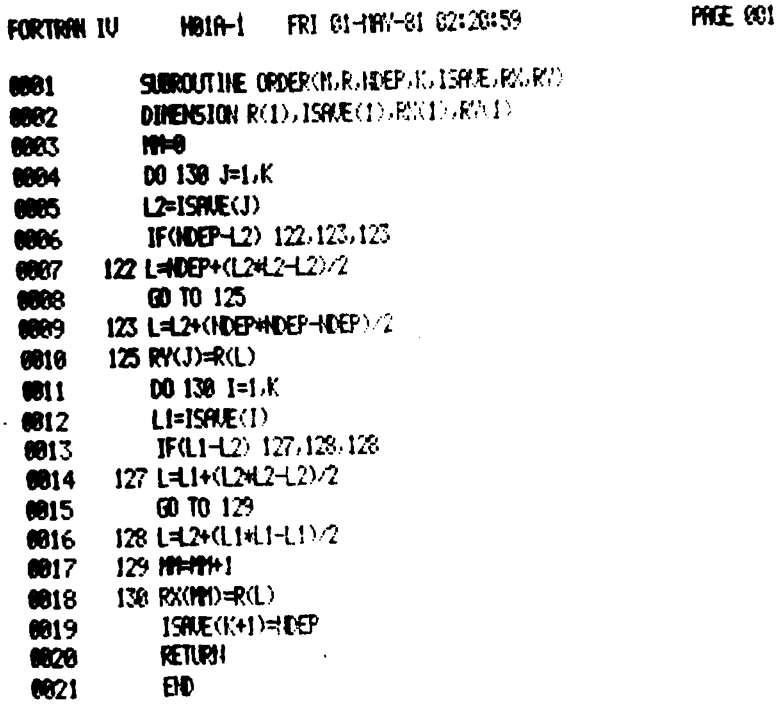
Subroutine CORR

```
FORTRAN IV      H01A-1    FRI 01-MAY-81 02:20:41                PAGE 001

              SUBROUTINE CORR(N,M,X,XBAR,STD,RX,R,B,D,T)
              DIMENSION X(1),XBAR(1),STD(1),RX(1),R(1),B(1),D(1),T(1)
              DO 100 J=1,M
              B(J)=0.0
        100   T(J)=0.0
              K=(M*M+M)/2
              DO 102 I=1,K
        102   R(I)=0.0
              FN=N
              L=0
              DO 108 J=1,M
              DO 107 I=1,N
              L=L+1
        107   T(J)=T(J)+X(L)
              XBAR(J)=T(J)
        108   T(J)=T(J)/FN
              DO 115 I=1,N
              JK=0
              L=I-N
              DO 110 J=1,M
              L=L+N
              D(J)=X(L)-T(J)
        110   B(J)=B(J)+D(J)
              DO 115 J=1,M
              DO 115 K=1,J
              JK=JK+1
        115   R(JK)=R(JK)+D(J)*D(K)
              JK=0
              DO 210 J=1,M
              XBAR(J)=XBAR(J)/FN
              DO 210 K=1,J
              JK=JK+1
        210   R(JK)=R(JK)-B(J)*B(K)/FN
              JK=0
              DO 220 J=1,M
              JK=JK+J
        220   STD(J)=SQRT(ABS(R(JK)))
              DO 230 J=1,M
              DO 230 K=J,M
              JK=J+(K*K-K)/2
              L=M*(J-1)+K
              RX(L)=R(JK)
              L=M*(K-1)+J
              RX(L)=R(JK)
              IF(STD(J)*STD(K)) 225,222,225
        222   R(JK)=0.0
              GO TO 230
        225   R(JK)=R(JK)/(STD(J)*STD(K))
        230   CONTINUE
              FN=SQRT(FN-1.0)
              DO 240 J=1,M
        240   STD(J)=STD(J)/FN
              L=-M
              DO 250 I=1,M
```

Subroutine CORR (Concluded)

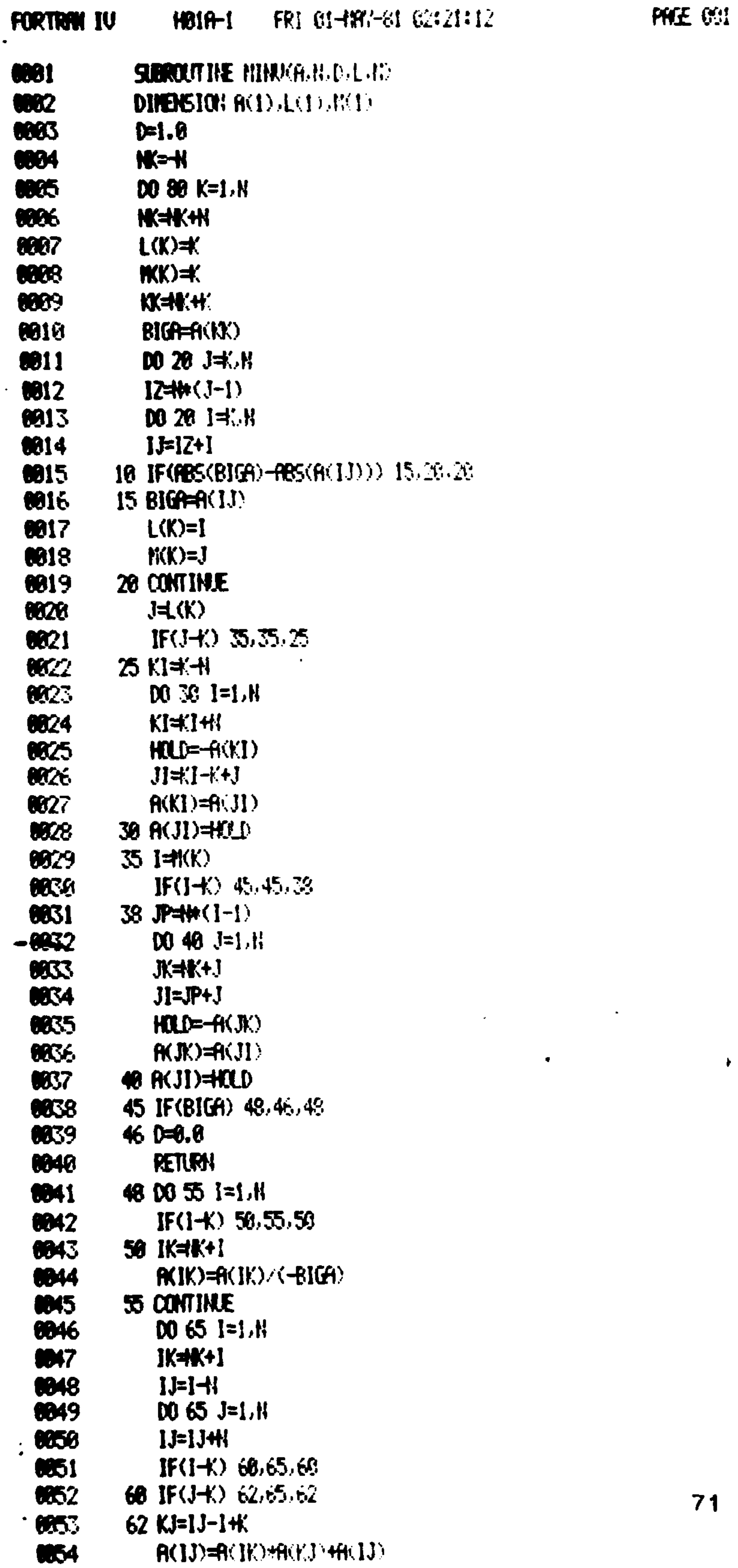
```
                                                              PAGE 002
FORTRAN IV     H01A-1    FRI 01-MAY-81 02:20:41

0055        L=L+MM+1
0056    250 B(I)=RX(L)
0057        RETURN
0058        END
```

Subroutine ORDER



```
FORTRAN IV      H01A-1    FRI 01-MAY-81 02:20:59             PAGE 001

          SUBROUTINE ORDER(M,R,NDEP,K,ISAVE,RX,RY)
          DIMENSION R(1),ISAVE(1),RX(1),RY(1)
          MM=0
          DO 130 J=1,K
          L2=ISAVE(J)
          IF(NDEP-L2) 122,123,123
      122 L=NDEP+(L2*L2-L2)/2
          GO TO 125
      123 L=L2+(NDEP*NDEP-NDEP)/2
      125 RY(J)=R(L)
          DO 130 I=1,K
          L1=ISAVE(I)
          IF(L1-L2) 127,128,128
      127 L=L1+(L2*L2-L2)/2
          GO TO 129
      128 L=L2+(L1*L1-L1)/2
      129 MM=MM+1
      130 RX(MM)=R(L)
          ISAVE(K+1)=NDEP
          RETURN
          END
```

Subroutine MINV



```
FORTRAN IV      H01A-1   FRI 01-MAY-81 02:21:12              PAGE 001

      SUBROUTINE MINV(A,N,D,L,M)
      DIMENSION A(1),L(1),M(1)
      D=1.0
      NK=-N
      DO 80 K=1,N
      NK=NK+N
      L(K)=K
      M(K)=K
      KK=NK+K
      BIGA=A(KK)
      DO 20 J=K,N
      IZ=N*(J-1)
      DO 20 I=K,N
      IJ=IZ+I
   10 IF(ABS(BIGA)-ABS(A(IJ))) 15,20,20
   15 BIGA=A(IJ)
      L(K)=I
      M(K)=J
   20 CONTINUE
      J=L(K)
      IF(J-K) 35,35,25
   25 KI=K-N
      DO 30 I=1,N
      KI=KI+N
      HOLD=-A(KI)
      JI=KI-K+J
      A(KI)=A(JI)
   30 A(JI)=HOLD
   35 I=M(K)
      IF(I-K) 45,45,38
   38 JP=N*(I-1)
      DO 40 J=1,N
      JK=NK+J
      JI=JP+J
      HOLD=-A(JK)
      A(JK)=A(JI)
   40 A(JI)=HOLD
   45 IF(BIGA) 48,46,48
   46 D=0.0
      RETURN
   48 DO 55 I=1,N
      IF(I-K) 50,55,50
   50 IK=NK+I
      A(IK)=A(IK)/(-BIGA)
   55 CONTINUE
      DO 65 I=1,N
      IK=NK+I
      IJ=I-N
      DO 65 J=1,N
      IJ=IJ+N
      IF(I-K) 60,65,60
   60 IF(J-K) 62,65,62
   62 KJ=IJ-I+K
      A(IJ)=A(IK)*A(KJ)+A(IJ)
```

```
FORTRAN IV      H01A-1    FRI 01-MAY-81 02:21:12              PAGE 002

      65 CONTINUE
         KJ=K-N
         DO 75 J=1,N
         KJ=KJ+N
         IF(J-K) 70,75,70
      70 A(KJ)=A(KJ)/BIGA
      75 CONTINUE
         D=D*BIGA
         A(KK)=1.0/BIGA
      80 CONTINUE
         K=N
     100 K=K-1
         IF(K) 150,150,105
     105 I=L(K)
         IF(I-K) 120,120,108
     108 JQ=N*(K-1)
         JR=N*(I-1)
         DO 110 J=1,N
         JK=JQ+J
         HOLD=A(JK)
         JI=JR+J
         A(JK)=-A(JI)
     110 A(JI)=HOLD
     120 J=M(K)
         IF(J-K) 100,100,125
     125 KI=K-N
         DO 130 I=1,N
         KI=KI+N
         HOLD=A(KI)
         JI=KI-K+J
         A(KI)=-A(JI)
     130 A(JI)=HOLD
         GO TO 100
     150 CONTINUE
         RETURN
         END
```

Subroutine MULTR

```
FORTRAN IV      H01A-1    FPI 01-MAY-81 02:21:31              PAGE 001

      SUBROUTINE MULTR(N,K,XBAR,STD,D,RX,RY,ISAVE,B,SB,T,ANS)
      DIMENSION XBAR(1),STD(1),D(1),RX(1),RY(1),
     1          ISAVE(1),B(1),SB(1),T(1),ANS(1)
      MM=K+1
      DO 100 J=1,K
  100 B(J)=0.0
      DO 110 J=1,K
      LI=K*(J-1)
      DO 110 I=1,K
      L=LI+I
  110 B(J)=B(J)+RY(I)*RX(L)
      RM=0.0
      BO=0.0
      LI=ISAVE(MM)
      DO 120 I=1,K
      RM=RM+B(I)*RY(I)
      L=ISAVE(I)
      B(I)=B(I)*(STD(LI)/STD(L))
  120 BO=BO+B(I)*XBAR(L)
      BO=XBAR(LI)-BO
      SSAR=RM*D(LI)
      RM=SQRT(ABS(RM))
      SSDR=D(LI)-SSAR
      FN=N-K-1
      SY=SSDR/FN
      DO 130 J=1,K
      LI=K*(J-1)+J
      L=ISAVE(J)
  125 SB(J)=SQRT(ABS((RX(LI)/D(L))*SY))
  130 T(J)=B(J)/SB(J)
  135 SY=SQRT(ABS(SY))
      FK=K
      SSARM=SSAR/FK
      SSDRM=SSDR/FN
      F=SSARM/SSDRM
      ANS(1)=BO
      ANS(2)=RM
      ANS(3)=SY
      ANS(4)=SSAR
      ANS(5)=FK
      ANS(6)=SSARM
      ANS(7)=SSDR
      ANS(8)=FN
      ANS(9)=SSDRM
      ANS(10)=F
      RETURN
      END
```

Subroutine LWRITE

```
FORTRAN IV      V01A-1    FRI 01-MAY-81 02:21:47                PAGE 03.

0001          SUBROUTINE LWRITE(IREAD,NVAR,NIVAR,XBAR,STD,SCP,DSCP,RX,RY,ISAVE,
             1                   RCOEF,SDRC,TVAL,ANS,IUNIT,INDEP)
0002          DIMENSION XBAR(1),STD(1),SCP(1),DSCP(1),RX(1),RY(1),
             1            ISAVE(1),RCOEF(1),SDRC(1),TVAL(1),ANS(1)
0003          NVAR1=NIVAR+1
0004          WRITE(IUNIT,6110)
0005          WRITE(IUNIT,6120) IREAD
0006          WRITE(IUNIT,6130) NVAR
0007          WRITE(IUNIT,6140) NIVAR
0008          WRITE(IUNIT,6150) (ISAVE(I),I=1,NIVAR)
0009          WRITE(IUNIT,6160) ISAVE(NIVAR+1)
0010          WRITE(IUNIT,6170)
0011          DO 100 I=1,NIVAR
0012          J=ISAVE(I)
0013          WRITE(IUNIT,6180) J,XBAR(J),STD(J)
0014      100 CONTINUE
0015          WRITE(IUNIT,6190) XBAR(INDEP),STD(INDEP)
0016          WRITE(IUNIT,6191)
0017          DO 110 I=1,NVAR1
0018          DO 105 J=1,NVAR1
0019          I1=ISAVE(I)
0020          J1=ISAVE(J)
0021          IF(J1.LE.I1) GO TO 105
0023          K=(I1-1)*NVAR+J1
0024          WRITE(IUNIT,6192) I1,J1,SCP(K)
0025      105 CONTINUE
0026      110 CONTINUE
0027          WRITE(IUNIT,6193)
0028          DO 120 I=1,NIVAR
0029          DO 115 J=1,NIVAR
0030          IF(J.LE.I) GO TO 115
0032          K=(I-1)*NIVAR+J
0033          WRITE(IUNIT,6194) ISAVE(I),ISAVE(J),RX(K)
0034      115 CONTINUE
0035      120 CONTINUE
0036          WRITE(IUNIT,6195) ISAVE(NVAR1)
0037          DO 125 I=1,NIVAR
0038          WRITE(IUNIT,6196) ISAVE(I),RY(I)
0039      125 CONTINUE
0040          WRITE(IUNIT,6197)
0041          DO 130 I=1,NVAR1
0042          J=ISAVE(I)
0043          IF(DSCP(J).GT.999999999.0) GO TO 129
0045          WRITE(IUNIT,6198) J,DSCP(J)
0046          GO TO 130
0047      129 CONTINUE
0048          WRITE(IUNIT,6199) J,DSCP(J)
0049      130 CONTINUE
0050          WRITE(IUNIT,6200)
0051          DO 200 I=1,NIVAR
0052          WRITE(IUNIT,6210) ISAVE(I),RCOEF(I),SDRC(I),TVAL(I)
0053      200 CONTINUE
0054          WRITE(IUNIT,6220) ANS(1)
0055          WRITE(IUNIT,6230) ANS(2)
```

Subroutine LWRITE (Continued)

```
FORTRAN IV      H01A-1    FRI 01-MAY-81 02:21:47              PAGE 002

 0056          R2=ANS(2)**2
 0057          WRITE(IUNIT,6231) R2
 0058          WRITE(IUNIT,6240) ANS(3)
 0059          WRITE(IUNIT,6250)
 0060          WRITE(IUNIT,6260) ANS(4),ANS(5),ANS(6),ANS(10)
 0061          WRITE(IUNIT,6270) ANS(7),ANS(8),ANS(9)
 0062          RETURN
 0063    6110 FORMAT(' '/' '/' MULTIPLE LINEAR REGRESSION')
 0064    6120 FORMAT(' NUMBER OF OBSERVATIONS = ',I7)
 0065    6130 FORMAT(' NUMBER OF VARIABLES = ',I7)
 0066    6140 FORMAT(' NUMBER OF INDEPENDENT VARIABLES = ',I3)
 0067    6150 FORMAT(' INDICES OF INDEPENDENT VARIABLES:'/
              1       ' ',19I4)
 0068    6160 FORMAT(' INDEX OF DEPENDENT VARIABLE: ',I4)
 0069    6170 FORMAT(' '/' MEANS AND STANDARD DEVIATIONS OF INDEPENDENT ',
              1            'VARIABLES:'/
              1       ' INDEX',8X,'MEAN',8X,'SDEV'/
              2       ' -----',8X,'----',8X,'----'/
              3       ' ')
 0070    6180 FORMAT(1X,I5,1X,F11.3,1X,F11.3)
 0071    6190 FORMAT(' '/' MEAN OF DEPENDENT VARIABLE = ',F11.3/
              1            ' STANDARD DEVIATION OF DEPENDENT VARIABLE = ',F11.3)
 0072    6191 FORMAT(' '/' SUM OF CROSS PRODUCTS:'/
              1       ' INDEX',2X,'INDEX',7X,'SUMCP'/
              2       ' -----',2X,'-----',7X,'-----'/
              3       ' ')
 0073    6192 FORMAT(1X,I5,2X,I5,1X,F11.3)
 0074    6193 FORMAT(' '/' INDEPENDENT VARIABLE CORRELATIONS:'/
              1       ' INDEX',2X,'INDEX',6X,'CORR'/
              2       ' -----',2X,'-----',6X,'----'/
              3       ' ')
 0075    6194 FORMAT(1X,I5,2X,I5,1X,F9.3)
 0076    6195 FORMAT(' '/' CORRELATIONS WITH DEPENDENT VARIABLE: ',I3/
              1       ' INDEX',6X,'CORR'/
              2       ' -----',6X,'----'/
              3       ' ')
 0077    6196 FORMAT(1X,I5,1X,F9.3)
 0078    6197 FORMAT(' '/' SUM OF SQUARES:'/
              1       ' INDEX',9X,'SUMSQ'/
              2       ' -----',9X,'-----'/
              3       ' ')
 0079    6198 FORMAT(1X,I5,1X,F13.3)
 0080    6199 FORMAT(1X,I5,1X,F13.0)
 0081    6200 FORMAT(' '/' REGRESSION COEFFICIENTS:'/
              1       ' INDEX',10X,'COEF',10X,'SDEV',5X,'T-VALUE'/
              2       ' -----',10X,'----',10X,'----',5X,'-------'/
              3       ' ')
 0082    6210 FORMAT(1X,I5,1X,F13.7,1X,F13.7,1X,F11.3)
 0083    6220 FORMAT(' '/' INTERCEPT = ',F11.3)
 0084    6230 FORMAT(' '/' MULTIPLE CORRELATION COEFFICIENT = ',F6.3)
 0085    6231 FORMAT(' '/' EXPLAINED VARIANCE = ',F6.3)
 0086    6240 FORMAT(' '/' STANDARD ERROR OF ESTIMATE = ',F11.3)
 0087    6250 FORMAT(' '/' ANALYSIS OF VARIANCE TABLE'/
              1       ' SOURCE',8X,'SUMSQ',5X,'DF',8X,'MEANSQ',6X,'F-RATIO'
```

Subroutine LWRITE (Concluded)

```
FORTRAN IV      H01A-1    FRI 01-MAY-81 02:21:47              PAGE 003

             2        ' ------',8X,' -----',5X,'--',8X,'------',6X,'-------'
             3        ' ')
0088    6260 FORMAT(' REG',4X,F12.3,1X,F6.0,1X,F13.5,1X,F12.3)
0089    6270 FORMAT(' RES',4X,F12.3,1X,F6.0,1X,F13.5)
0090         END
```

Table 10

MLREG1.FOR

Multiple Linear Regression

Purpose: Performs a multiple linear regression.

Explanation:

Enter # of observations = total # of observations

Enter # of variables = total # of independent and dependent variables in your file

Enter # of independent variables = total # you are going to use for this regression

Indices of independent variables = the numbers that correspond to the independent variables in your file

Computer Output	User Input
	● Run MLREG1
Pause -- Insert data disc in unit one (DK:) and hit return	‹CR›
Name the input file (Assign)	*DK:F20935.DAT ‹CR›
Enter number of observations(I)	180 ‹CR›
Enter number of variables (I)	16 ‹CR›

Table 10

MLREG1.FOR (Concluded)

Multiple Linear Regression	
Computer Output	User Input
Enter number of independent variables (I)	3 ⟨CR⟩
Enter indices of independent variables (19I4)	8, 10, 15 ⟨CR⟩
Enter index of dependent (I)	16 ⟨CR⟩
Enter the output unit number (6 = LP, 7 = TT)	6 ⟨CR⟩
Enter the input format specification (20A2)[1]	(16F20.10) ⟨CR⟩

[1] Whenever formats are indicated, parentheses must be used.

```
MULTIPLE LINEAR REGRESSION
NUMBER OF OBSERVATIONS =     174
NUMBER OF VARIABLES =     16
NUMBER OF INDEPENDENT VARIABLES =   2
INDICES OF INDEPENDENT VARIABLES:
  8  10
INDEX OF DEPENDENT VARIABLE:   16

MEANS AND STANDARD DEVIATIONS OF INDEPENDENT VARIABLES:
INDEX        MEAN        SDEV
-----        ----        ----


   8        0.787       0.292
  10        0.472       0.425

MEAN OF DEPENDENT VARIABLE =        0.406
STANDARD DEVIATION OF DEPENDENT VARIABLE =        0.381

SUM OF CROSS PRODUCTS:
INDEX  INDEX       SUMCP
-----  -----       -----


   8     10      12.489
   8     16      15.316
  10     16      13.860

INDEPENDENT VARIABLE CORRELATIONS:
INDEX  INDEX       CORR
-----  -----       ----


   8     10     0.582

CORRELATIONS WITH DEPENDENT VARIABLE:  16
INDEX      CORR
-----      ----


   8     0.796
  10     0.674

SUM OF SQUARES:
INDEX         SUMSQ
-----         -----


   8         14.777
  10         31.196
  16         25.090

REGRESSION COEFFICIENTS:
INDEX          COFF          SDEV     T-VALUE
-----          ----          ----     -------


   8     0.7941886     0.0670284      11.843
  10     0.2866121     0.0461322       6.213

INTERCEPT =        0.043

MULTIPLE CORRELATION COEFFICIENT =  0.837
```

Example Output MLREG1 (Concluded)

```
EXPLAINED VARIANCE =  0.701

STANDARD ERROR OF ESTIMATE =       0.210

ANALYSIS OF VARIANCE TABLE
SOURCE        SUMSQ    DF        MEANSQ     F-RATIO
------        -----    --        ------     -------

REG          17.569     2.      8.78448     199.983
RES           7.511   171.      0.04393
```

```
FORTRAN IV      H01A-1    FRI 08-MAY-81 08:38:48            PAGE 001

C PROGRAM 'HADMRD.FOR'
C CREATED FOR THE H11A: 9-JAN-80
C PURPOSE IS TO PERFORM A FAST HADAMARD TRANSFORM
C FOR A VARIABLE NUMBER OF BOOLEAN TIME SEQUENCE RECORDS
C CONTROL INPUT DEFINES THE SIZE OF THE HADAMARD MATRIX,
C NUMBER OF BITS IN BOOLEAN TIME SEQUENCE, NUMBER OF
C SHIFTS TO PERFORM ON BTS, AND THE LENGTH OF A SHIFT
C THIS PROGRAM IS A PART OF THE ABSOLUTE COMPUTATION
C PROCEDURE FOR THE 'MAP' SYSTEM
      COMMON /HBLOCK/ IB,IHDDIM,IPOW2
      DIMENSION IBTS(1024),IB(128),STAT(128,2)
      PAUSE 'INSERT DATA DISC IN UNIT ONE (DK:) AND HIT RETURN'
C INPUT CONTROL VARIABLES
      WRITE(7,7100)
      CALL ASSIGN(1,' ',-1,'RDO','NC',1)
      WRITE(7,7110)
      CALL ASSIGN(2,' ',-1,'NEW','NC',1)
      WRITE(7,7120)
      READ(5,5100) IPOW2
      WRITE(7,7130)
      READ(5,5100) LENBTS
      WRITE(7,7140)
      READ(5,5100) NSHIFT
      WRITE(7,7150)
      READ(5,5100) LENSHF
C COMPUTE OTHER CONTROL VARIABLES
      IHDDIM=2**IPOW2
      PSIZE=FLOAT(IHDDIM)
      NSHF1=NSHIFT+1
      PSSIZE=FLOAT(NSHF1)
      IREAD=0
C READ ONE BTS RECORD
  100 CONTINUE
      READ(1,1100,END=700) (IBTS(I),I=1,LENBTS)
      IREAD=IREAD+1
      IF(LENBTS.GE.1024) GO TO 120
      ISTART=LENBTS+1
      DO 110 I=ISTART,1024
      IBTS(I)=0
  110 CONTINUE
  120 CONTINUE
C COUNT NUMBER OF ONES AND ZEROS IN BOOLEAN TIME SEQUENCE
      IONE=0
      IZERO=0
      DO 130 I=1,LENBTS
      IF(IBTS(I).EQ.1) IONE=IONE+1
      IF(IBTS(I).EQ.0) IZERO=IZERO+1
  130 CONTINUE
C INTIALIZE POPULATION TOTALS
      PATOT=0.0
      PATOT2=0.0
      PUTOT=0.0
      PUTOT2=0.0
C INTIALIZE STATISTIC MATRIX
```

Program Listing HADMRD (Continued)

```
FORTRAN IV      H01A-1    FRI 08-MAY-81 08:38:48          PAGE 002

      DO 200 I=1,IHDDIM
      STAT(I,1)=0.0
      STAT(I,2)=0.0
  200 CONTINUE
C SHIFT BTS TO WORKING VECTOR
      DO 500 I=1,NSHF1
      INDEX=0
      JSTART=(I-1)*LENSHF+1
      JSTOP=JSTART+IHDDIM-1
      DO 300 J=JSTART,JSTOP
      INDEX=INDEX+1
      IB(INDEX)=IBTS(J)
      IF(IB(INDEX).EQ.0) IB(INDEX)=(-1)
  300 CONTINUE
C PERFORM FAST HADAMARD TRANSFORM
      CALL HADMRD
C GATHER STATISTICAL DATA
      DO 400 J=1,IHDDIM
      STAT(J,1)=STAT(J,1)+FLOAT(IB(J))
      STAT(J,2)=STAT(J,2)+FLOAT(IB(J)**2)
  400 CONTINUE
  500 CONTINUE
C OUTPUT THE SOLUTION FOR THE CURRENT BOOLEAN TIME SEQUENCE
      WRITE(7,7160) IREAD,LENBTS,IONE,IZERO,IHDDIM,NSHIFT,LENSHF,NSHF1
      WRITE(2,2100) IREAD,LENBTS,IONE,IZERO,IHDDIM,NSHIFT,LENSHF,NSHF1
      DO 600 I=1,IHDDIM
      SMEAN=STAT(I,1)/RSSIZE
      IF(NSHF1.LE.2) SVAR=0.0
      IF(NSHF1.GT.2) SVAR=(STAT(I,2)-(STAT(I,1)*STAT(I,1)/RSSIZE))
     1                         /(RSSIZE-1.0)
      WRITE(7,7170) I,STAT(I,1),STAT(I,2),SMEAN,SVAR
      WRITE(2,2110) I,SMEAN,SVAR
      PMTOT=PMTOT+SMEAN
      PMTOT2=PMTOT2+SMEAN*SMEAN
      PVTOT=PVTOT+SVAR
      PVTOT2=PVTOT2+SVAR*SVAR
  600 CONTINUE
      PMMEAN=PMTOT/PSIZE
      PMVAR=(PMTOT2-(PMTOT*PMTOT/PSIZE))/PSIZE
      PVMEAN=PVTOT/PSIZE
      PVVAR=(PVTOT2-(PVTOT*PVTOT/PSIZE))/PSIZE
      WRITE(7,7180) PMMEAN,PMVAR,PVMEAN,PVVAR
      WRITE(2,2120) PMMEAN,PMVAR,PVMEAN,PVVAR
C READ NEXT BOOLEAN TIME SEQUENCE
      GO TO 100
C END OF PROGRAM
  700 CONTINUE
      STOP 'END OF PROGRAM HADMRD.FOR'
 1100 FORMAT(128I1)
 2100 FORMAT(8I5)
 2110 FORMAT(I3,2F9.3)
 2120 FORMAT(4F13.3)
 5100 FORMAT(I7)
 7100 FORMAT(' NAME THE INPUT FILE (ASSIGN)'/)
```

```
FORTRAN IV      H01A-1    FRI 08-MAY-81 08:39:48              PAGE 003

      7110 FORMAT(' NAME THE RESULT FILE (ASSIGN)'/)
      7120 FORMAT(' WHAT POWER OF 2 EQUALS HADAMARD SIZE (I)')
      7130 FORMAT(' WHAT IS LENGTH OF INPUT BOOLEAN TIME SEQUENCE (I)')
      7140 FORMAT(' HOW MANY SHIFTS APE TO BE PERFORMED ON SAMPLE (I)')
      7150 FORMAT(' WHAT IS THE LENGTH OF A SHIFT (I)')
      7160 FORMAT(' FAST HADAMARD TRANSFORM'/
          1       ' INPUT BTS =       ',I7/
          2       ' LENGTH OF BTS =   ',I7/
          2       ' NUMBER OF ONES IN BTS = ',I7/
          2       ' NUMBEP OF ZEPOS IN BTS = ',I7/
          3       ' HADAMARD SIZE =   ',I7/
          4       ' NUMBEP OF SHIFTS =',I7/
          5       ' LENGTH OF SHIFT = ',I7/
          6       ' SAMPLE SIZE =     ',I7/
          7       ' '/
          8       ' HADAMARD',7X,'SUMX',5X,'SUMXSQ',7X,'MEAN',3X,
          9       'VARIANCE'/
          9       ' --------',7X,'----',5X,'------',7X,'----',3X,
          9       '--------'/
          9       ' ')
      7170 FORMAT(' ',1X,I7,2(1X,F10.0),2(2X,F9.3))
      7180 FORMAT(' POPULATION STATISTICS'/
          1       ' MEAN OF MEANS =          ',F13.3/
          2       ' VARIANCE OF MEANS =      ',F13.3/
          3       ' MEAN OF VARIANCES =      ',F13.3/
          4       ' VARIANCE OF VARIANCES = ',F13.3)
           END
```

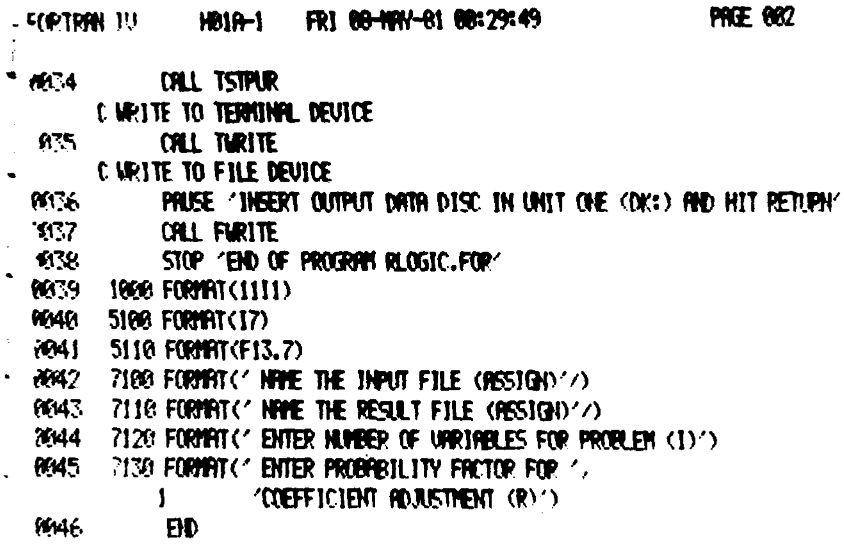
Subroutine HADMRD

```
FORTRAN IV      H01A-1    FRI 08-MAY-81 08:39:09             PAGE 001

0001          SUBROUTINE HADMRD
        C PURPOSE IS TO PEPFORM A FAST HADAMARD TRANSFORM
        C ON AN INPUT BOOLEAN TIME SEQUENCE
0002          COMMON /HBLOCK/ IB,JSTOP,ISTOP
0003          DIMENSION IA(128),IB(128)
0004          DO 500 I=1,ISTOP
0005          INDEX=1
0006          JINC=2**I
0007          KSTOP=2**(I-1)
0008          DO 300 J=1,JSTOP,JINC
0009          DO 100 K=1,KSTOP
0010          LOC1=J+K-1
0011          LOC2=LOC1+KSTOP
0012          IA(INDEX)=IB(LOC1)+IB(LOC2)
0013          INDEX=INDEX+1
0014     100  CONTINUE
0015          DO 200 K=1,KSTOP
0016          LOC1=J+K-1
0017          LOC2=LOC1+KSTOP
0018          IA(INDEX)=IB(LOC1)-IB(LOC2)
0019          INDEX=INDEX+1
0020     200  CONTINUE
0021     300  CONTINUE
0022          DO 400 J=1,JSTOP
0023          IB(J)=IA(J)
0024     400  CONTINUE
0025     500  CONTINUE
0026          RETURN
0027          END
```

Program Listing RLOGIC

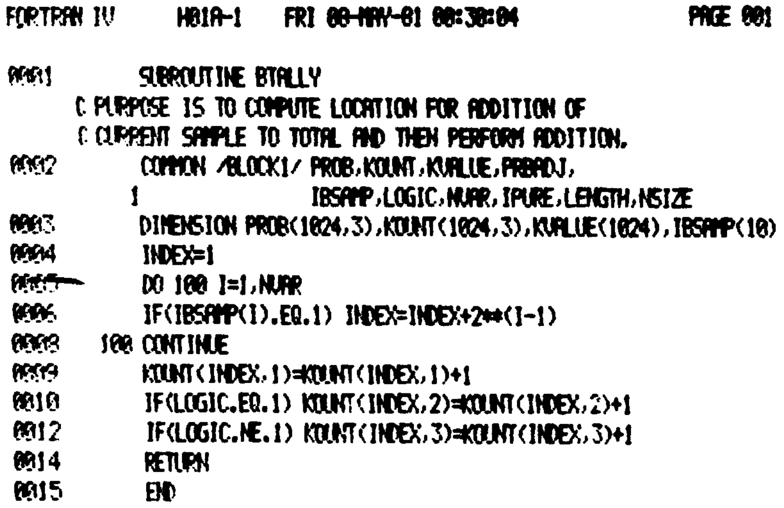
```
FORTRAN IV      H01A-1    FRI 08-MAY-81 08:29:49          PAGE 001

      C PROGRAM 'RLOGIC.FOR'
      C CREATED FOR THE H11A SYSTEM: 8-JAN-80
      C PURPOSE: ACCEPT A FILE OF BOOLEAN VARIABLES
      C AND A LOGICAL GOAL VARIABLE. COUNT THE NUMBER
      C OF OCCURENCES FOR ALL POSSIBLE COMBINATIONS
      C OF THE MINTERMS. COMPUTE THE PROBABILITIES
      C FOR THE EVENTS OF (1) MINTERM TRUE
      C (2) GOAL  TRUE GIVEN MINTERM TRUE
      C (3) GOAL  FALSE GIVEN MINTERM TRUE.
      C TEST FOR PURE LOGIC FUNCTION. WRITE OUTPUT
      C TO TERMINAL. WRITE OUTPUT FILE OF RESULTS.
      C THIS PROGRAM IS A PART OF THE RELATIVE
      C LOGIC PROCEDURE FOR THE 'MAP' SYSTEM.
0001        COMMON /BLOCK1/ PROB,KOUNT,KVALUE,PRBADJ,
           1                   IBSAMP,LOGIC,NVAR,IPURE,LENGTH,NSIZE
0002        DIMENSION PROB(1024,3),KOUNT(1024,3),KVALUE(1024),IBSAMP(10)
0003        PAUSE 'INSERT INPUT DATA DISC IN UNIT ONE (DK:) AND HIT RETURN'
      C NAME INPUT FILE
0004        WRITE(7,7100)
0005        CALL ASSIGN(1,' ',-1,'RDO','NC',1)
      C NAME OUTPUT FILE
0006        WRITE(7,7110)
0007        CALL ASSIGN(2,' ',-1,'NEW','NC',1)
      C ENTER NUMBER OF VARIABLES IN SAMPLE
0008        WRITE(7,7120)
0009        READ(5,5100) NVAR
      C ENTER THE COEFFICIENT ADJUSTMENT FACTOR
0010        WRITE(7,7130)
0011        READ(5,5110) PRBADJ
      C INITIALIZE VARIBALES
0012        IPURE=0
0013        NSIZE=0
0014        LENGTH=2**NVAR
0015        DO 100 I=1,1024
0016        KOUNT(I,1)=0
0017        KOUNT(I,2)=0
0018        KOUNT(I,3)=0
0019        PROB(I,1)=0.0
0020        PROB(I,2)=0.0
0021        PROB(I,3)=0.0
0022        KVALUE(I)=-1
0023        IF(I.GT.10) GO TO 100
0025        IBSAMP(I)=0
0026    100 CONTINUE
      C READ ONE RECORD AND COUNT
0027    200 CONTINUE
0028        READ(1,1000,END=300) (IBSAMP(I),I=1,NVAR),LOGIC
0029        NSIZE=NSIZE+1
0030        CALL BTALLY
0031        GO TO 200
      C COMPUTE PROBABILTIES
0032    300 CONTINUE
0033        CALL RLPROB
      C TEST FOR PURITY OF LOGIC FUNCTION
```

Program Listing RLOGIC (Concluded)



```
FORTRAN IV      H01A-1    FRI 08-MAY-81 08:29:49              PAGE 002

              CALL TSTPUR
        C WRITE TO TERMINAL DEVICE
              CALL TWRITE
        C WRITE TO FILE DEVICE
              PAUSE 'INSERT OUTPUT DATA DISC IN UNIT ONE (DK:) AND HIT RETURN'
              CALL FWRITE
              STOP 'END OF PROGRAM RLOGIC.FOR'
         1000 FORMAT(1I11)
         5100 FORMAT(I7)
         5110 FORMAT(F13.7)
         7100 FORMAT(' NAME THE INPUT FILE (ASSIGN)'/)
         7110 FORMAT(' NAME THE RESULT FILE (ASSIGN)'/)
         7120 FORMAT(' ENTER NUMBER OF VARIABLES FOR PROBLEM (I)')
         7130 FORMAT(' ENTER PROBABILITY FACTOR FOR ',
             1        'COEFFICIENT ADJUSTMENT (R)')
               END
```

Subroutine BTALLY

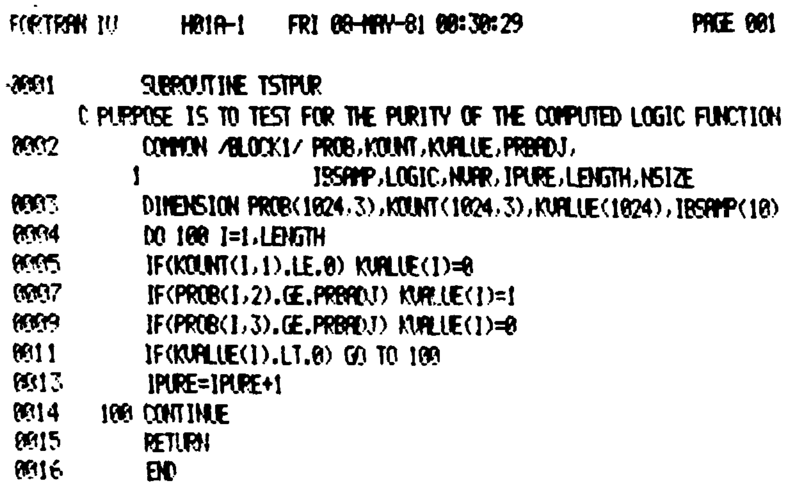


```
FORTRAN IV      H01A-1   FRI 08-MAY-81 08:38:04             PAGE 001

0001        SUBROUTINE BTALLY
      C PURPOSE IS TO COMPUTE LOCATION FOR ADDITION OF
      C CURRENT SAMPLE TO TOTAL AND THEN PERFORM ADDITION.
0002        COMMON /BLOCK1/ PROB,KOUNT,KVALUE,PRBADJ,
           1                IBSAMP,LOGIC,NVAR,IPURE,LENGTH,NSIZE
0003        DIMENSION PROB(1024,3),KOUNT(1024,3),KVALUE(1024),IBSAMP(10)
0004        INDEX=1
0005        DO 100 I=1,NVAR
0006        IF(IBSAMP(I).EQ.1) INDEX=INDEX+2**(I-1)
0008    100 CONTINUE
0009        KOUNT(INDEX,1)=KOUNT(INDEX,1)+1
0010        IF(LOGIC.EQ.1) KOUNT(INDEX,2)=KOUNT(INDEX,2)+1
0012        IF(LOGIC.NE.1) KOUNT(INDEX,3)=KOUNT(INDEX,3)+1
0014        RETURN
0015        END
```

Subroutine RLPROB

```
FORTRAN IV      V01A-1    FRI 08-MAY-81 08:30:16              PAGE 001

0001          SUBROUTINE RLPROB
        C PURPOSE IS TO COMPUTE THE PROBABILITIES FOR LOGIC FUNCTION
0002          COMMON /BLOCK1/ PROB,KOUNT,KVALUE,PRBADJ,
            1                   IBSAMP,LOGIC,NVAR,IPURE,LENGTH,NSIZE
0003          DIMENSION PROB(1024,3),KOUNT(1024,3),KVALUE(1024),IBSAMP(10)
0004          RSIZE=FLOAT(NSIZE)
0005          DO 100 I=1,LENGTH
0006          IF(KOUNT(I,1).LE.0) GO TO 100
0008          COUNT1=FLOAT(KOUNT(I,1))
0009          COUNT2=FLOAT(KOUNT(I,2))
0010          COUNT3=FLOAT(KOUNT(I,3))
0011          PROB(I,1)=COUNT1/RSIZE
0012          PROB(I,2)=COUNT2/COUNT1
0013          PROB(I,3)=COUNT3/COUNT1
0014      100 CONTINUE
0015          RETURN
0016          END
```

Subroutine TSTPUR



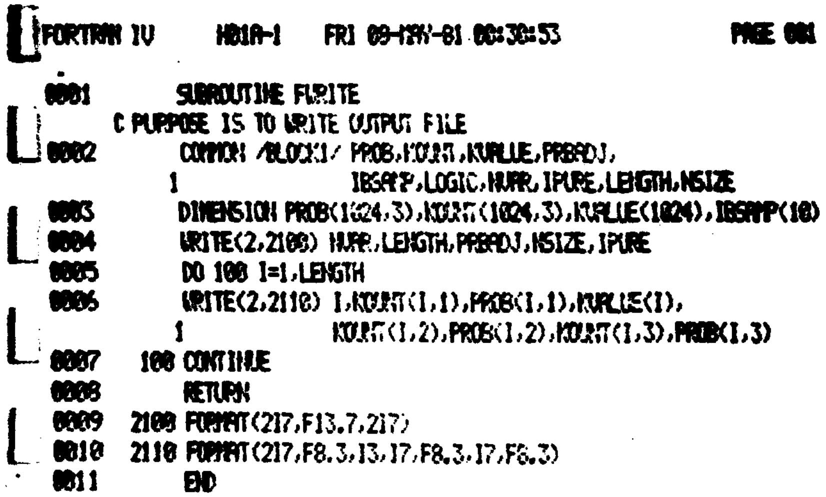
```
FORTRAN IV      H01A-1    FRI 08-MAY-81 08:30:29                PAGE 001

             SUBROUTINE TSTPUR
       C PURPOSE IS TO TEST FOR THE PURITY OF THE COMPUTED LOGIC FUNCTION
             COMMON /BLOCK1/ PROB,KOUNT,KVALUE,PRBADJ,
           1                IBSAMP,LOGIC,NVAR,IPURE,LENGTH,NSIZE
             DIMENSION PROB(1024,3),KOUNT(1024,3),KVALUE(1024),IBSAMP(10)
             DO 100 I=1,LENGTH
             IF(KOUNT(I,1).LE.0) KVALUE(I)=0
             IF(PROB(I,2).GE.PRBADJ) KVALUE(I)=1
             IF(PROB(I,3).GE.PRBADJ) KVALUE(I)=0
             IF(KVALUE(I).LT.0) GO TO 100
             IPURE=IPURE+1
         100 CONTINUE
             RETURN
             END
```

Subroutine TWRITE

```
FORTRAN IV      H01A-1    FRI 08-MAY-81 00:30:41              PAGE 001

0001        SUBROUTINE TWRITE
      C PURPOSE IS TO WRITE TO TERMINAL
0002        COMMON /BLOCK1/ PROB,KOUNT,KVALUE,PRBADJ,
          1                  IBSAMP,LOGIC,NVAR,IPURE,LENGTH,NSIZE
0003        DIMENSION PROB(1024,3),KOUNT(1024,3),KVALUE(1024),IBSAMP(10)
0004        WRITE(7,7100) NVAR,LENGTH,PRBADJ
0005        WRITE(7,7110) NSIZE,IPURE
0006        WRITE(7,7120)
0007        DO 100 I=1,LENGTH
0008        WRITE(7,7130) I,KOUNT(I,1),PROB(I,1),KVALUE(I),
          1                 KOUNT(I,2),PROB(I,2),KOUNT(I,3),PROB(I,3)
0009    100 CONTINUE
0010        RETURN
0011   7100 FORMAT(' RELATIVE BOOLEAN LOGIC SEARCH FOR A LOGICIAL ',
          1        'FUNCTION OF THE MINTERMS'/
          2       ' NUMBER OF VARIABLES = ',I7/
          3       ' NUMBER OF MINTERMS =  ',I7/
          4       ' ADJUSTMENT FACTOR = ',F9.5)
0012   7110 FORMAT(' NUMBER OF SAMPLES =   ',I7/
          1       ' PURITY =                ',I7/
          2       ' PURITY SHOULD EQUAL THE NUMBER OF MINTERMS ',
          3       'FOR PURE LOGIC')
0013   7120 FORMAT(' ',3X,'MINTERM',4X,'MCOUNT',5X,'MPROB',
          1            6X,'TCEF',4X,'TCOUNT',
          2            5X,'TPROB',4X,'FCOUNT',5X,'FPROB'/
          3       ' ',3X,'-------',4X,'------',5X,'-----',
          4            6X,'----',4X,'------',
          5            5X,'-----',4X,'------',5X,'-----'/
          6       ' ')
0014   7130 FORMAT(' ',3X,I7,3X,I7,3X,F8.3,4X,I6,3X,I7,2X,F8.3,
          1            3X,I7,2X,F8.3)
0015        END
```

GLOSSARY OF TERMS

Subroutine FWRITE



```
FORTRAN IV      H01A-1    FRI 09-MAY-81 00:30:53                PAGE 001

 0001         SUBROUTINE FWRITE
        C PURPOSE IS TO WRITE OUTPUT FILE
 0002         COMMON /BLOCK1/ PROB,KOUNT,KVALUE,PRBADJ,
             1                  IBSAMP,LOGIC,NVAR,IPURE,LENGTH,NSIZE
 0003         DIMENSION PROB(1024,3),KOUNT(1024,3),KVALUE(1024),IBSAMP(10)
 0004         WRITE(2,2100) NVAR,LENGTH,PRBADJ,NSIZE,IPURE
 0005         DO 100 I=1,LENGTH
 0006         WRITE(2,2110) I,KOUNT(I,1),PROB(I,1),KVALUE(I),
             1               KOUNT(I,2),PROB(I,2),KOUNT(I,3),PROB(I,3)
 0007     100 CONTINUE
 0008         RETURN
 0009    2100 FORMAT(2I7,F13.7,2I7)
 0010    2110 FORMAT(2I7,F8.3,I3,I7,F8.3,I7,F8.3)
 0011         END
```

GLOSSARY OF TERMS

<CR>	Carriage Return
LP	Line Printer
TT	Teletype
(I)	Integer
(R)	Real number. A decimal point must be used with real numbers.
NTER ERMEAN	Enter Mean of Error
ERRDEV	Deviation of Error
RTMEAN	Mean Error Rate
RTDEV	Deviation Error Rate
FORMAT	Whenever a format is called for, parentheses must be used.